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Swimming Shermans

Sherman DD amphibious tank of World War II

David Fletcher • Illustrated by Tony Bryan

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U.S.A.
3070200

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First published in Great Britain in 2006 by Osprey Publishing,
Midland House, West Way, Botley, Oxford OX2 0PH, UK
443 Park Avenue South, New York, NY 10016, USA
E-mail: info@ospreypublishing.com

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A CIP catalogue record for this book is available from the British Library

ISBN 1 84176 983 5

Page layout by Melissa Orrom Swan, Oxford, UK
Index by Alan Thatcher
Originated by United Graphics Pte Ltd., Singapore
Printed in China through World Print Ltd.

06 07 08 09 10 10 9 8 7 6 5 4 3 2 1

For a catalogue of all books published by Osprey Military and Aviation please contact:

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E-mail: info@ospreydirect.com

ALL OTHER REGIONS
Osprey Direct UK, P.O. Box 140 Wellingborough, Northants, NN8 2FA, UK
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www.ospreypublishing.com

Author's acknowledgements

The author would like to acknowledge the help of Steve Zaloga, Richard Harley, Ken Jones, John Pearson and Brigadier Clendon Dawkes.

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SWIMMING SHERMANS: SHERMAN DD AMPHIBIOUS TANK OF WORLD WAR II

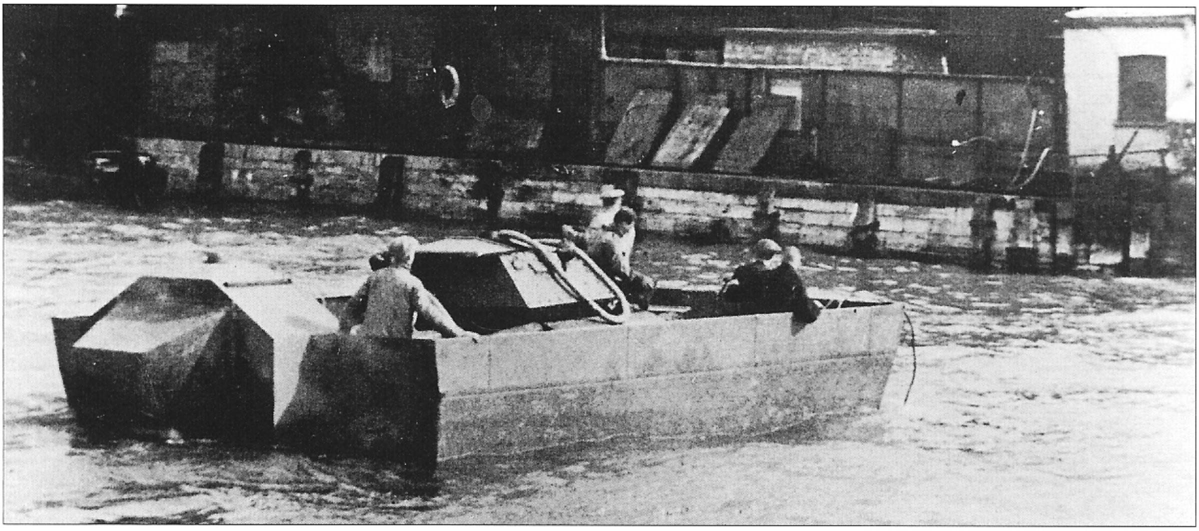
INTRODUCTION

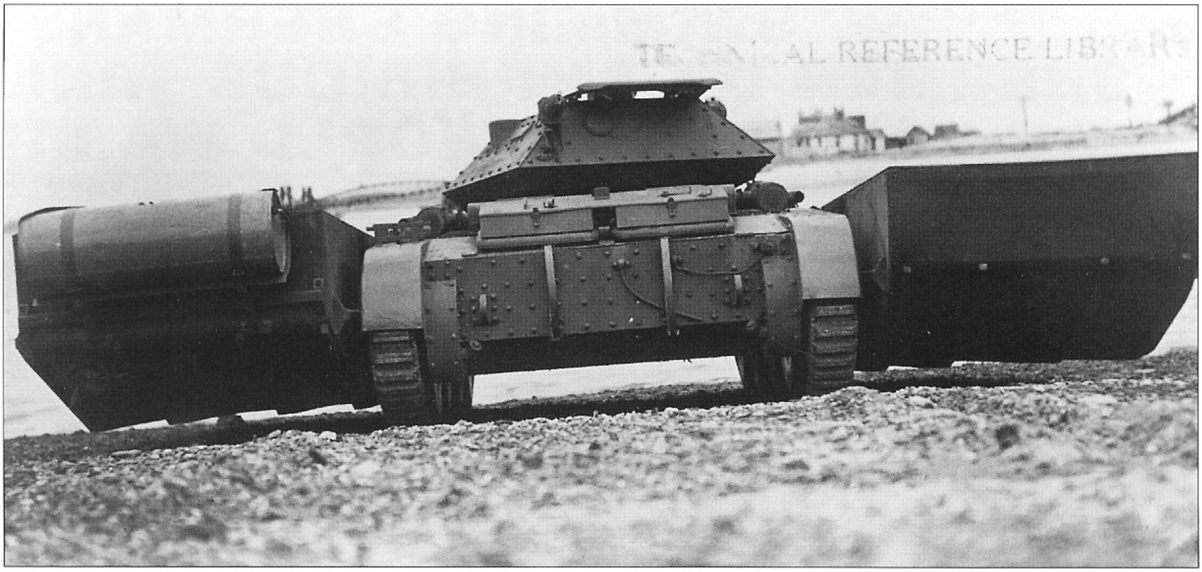
Most tank-producing nations had toyed with the concept of amphibious tanks in the years between the wars, and these appeared in two distinct forms. Either you had the conventional tank, made to float by the addition of buoyant attachments, or you had a tank designed from the drawing board to swim, which could simply drive into the water and sail away.

Problems and solutions

The former had the advantage that once the tank emerged from the water it could shed its flotation gear and roll into action like any other tank, with the same degree of firepower, protection and mobility. There were two serious drawbacks, however. In the first place the buoyancy aids were so bulky that they had to be carried around by transport and fitted, not without considerable effort, to the tank just before it took on its amphibious role. The location for this work had to be secure from enemy interference, but not so far from the water that the tank would need to travel any distance since it was quite likely to damage itself in the process. Inevitably these fixtures made the tank a lot wider, so the risk of damage against trees, buildings and other obstacles was very real and, if seaborne operations were contemplated, it would be too wide to pass through the bow section of a landing craft. In addition some other temporary modification was required to enable the tank to propel itself in the water; this could be anything from paddles bolted to the tracks,

With the turret of a Covenanter tank just visible above the bulwarks, a prototype of the 17-ton Lighter makes its way carefully from ship to shore in Portsmouth Harbour. The helmsman is in the housing at the back with the outboard drive in an extension at the rear.





Another Covenanter, here fitted with a pair of floats, prepares to take the plunge into Fareham Harbour. Notice how the long-range fuel tank, normally carried at the back of the Covenanter, has been transferred to the port-side float.

an outboard motor or some alteration to the transmission that provided conventional propeller drive.

The purpose-built amphibious tank was not so wide, since the hull itself was a significant part of the buoyancy factor and the drivetrain had been adapted at the design stage to incorporate a propeller and rudder. The drawback in this case was that thick armour was incompatible with buoyancy. Consequently, such tanks were vulnerable out of the water and, since they were invariably small vehicles, they could not carry much in the way of firepower and so their role on land was limited. Not only that, but, being small, they lacked freeboard and could only function safely on calm, inland waters.

Although one true amphibious tank was being tested in Britain shortly before the Second World War, much of the effort was concentrated upon making regular tanks float. This was done primarily at the Experimental Bridging Establishment at Christchurch in Hampshire and concerned Light Tanks Mark V and VI along with the two new cruiser tanks Covenanter and Crusader (see New Vanguard No. 14). In all cases making the vehicles amphibious involved fitting pontoons, as floats, to each side of the tank, with all the problems already mentioned. The only alternative was a small vessel known as the 17-ton Lighter.

The curious Lighter, looking like an enlarged shoebox fitted with an outboard motor, had been designed for use with a type of vessel known as a Landing Ship Stern Chute that was, in fact, a modified train ferry. The idea was to carry as many of the little Lighters as possible so that, on arrival off an invasion beach, one tank would be lifted into each Lighter and the combination launched down the vessel's stern chute to chug ashore. Thus each tank had its own means of amphibious transport but, once ashore, was ready to fight as a conventional tank. Trials were carried out in Portsmouth Harbour in the summer of 1941 but, according to a report published after the war, went no further due to the development of larger, tank-carrying landing craft. However, it is worth noting that work on the prototype Duplex Drive tank was going forward at the same time and this may also have had a bearing on the decision to drop the Lighter.

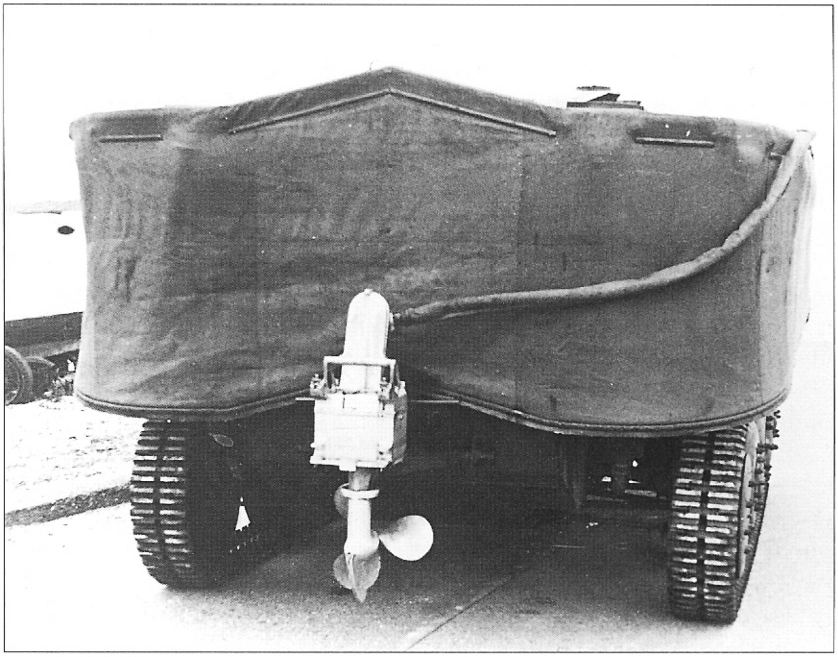
DESIGN AND DEVELOPMENT

Nicholas Straussler

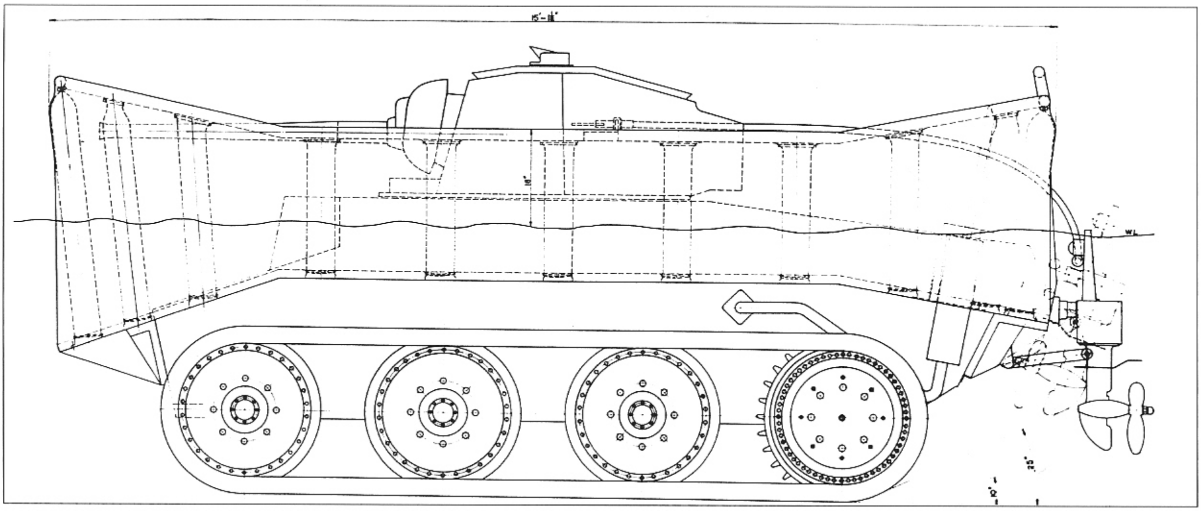
Born in 1891, Nicholas Straussler settled in Britain shortly before the Second World War. He already enjoyed a reputation as an innovative automotive engineer in his native Hungary, but by forming links with firms such as Alvis Ltd in Coventry and the armaments manufacturer Vickers he found more potential business in Britain. For the former he designed a range of armoured cars and for the latter, in the main, various attachments and accessories for tanks. Straussler's innovative streak could get out of hand, particularly with automotive projects that were not always practical. When it came to amphibious tanks, however, he could at least see the wood for the trees.

In a note written in 1945 Straussler claims that after examining various types of buoyant tanks he reached the conclusion that it made more sense to apply flotation equipment to standard designs. Thus, in cooperation with Vickers-Armstrong he developed a range of collapsible floats that could be used to create pontoon bridges and rafts or, attached to each side of a light tank, keep it afloat. The War Office was sufficiently interested to test this equipment and various light tanks were modified for trials, sometimes with the addition of an outboard motor. They appear to have worked well enough, but Straussler had visions of invasion beaches cluttered up with discarded floats after a landing, and duly turned his attention elsewhere.

One has to be cautious when dealing with recollections, particularly when the subject was amassing evidence for a Royal Commission that might result in a substantial reward, and Straussler's suggestion that he realized the limitations of his floats and cast about for an alternative as early as 1934 does seem a bit surprising. If true he was way ahead of the War Office, who persisted with the float idea well into the Second World War.



The prototype Tetrarch DD prior to its first swim in Langstone Harbour. The marine drive equipment can be seen at the back; notice how the propeller, which is controlled by the line that vanishes over the screen on the right, faces forwards.



Nicholas Straussler's drawing of the Tetrarch DD with its screen raised. Notice how the exhaust pipes would be extended to clear the screen and that, on this drawing at least, the propeller faces in the conventional way.

The prototype

Whenever it did occur to him, Straussler's idea was a stroke of genius. It was simple enough in theory since it relied upon displacement; the clever bit was Straussler's method of achieving it. In order to avoid the bulk normally associated with displacement he surrounded the tank with a collapsible, waterproof screen. This in turn was attached to the tank's hull, just above track level and the joint securely sealed, with the result that the upper half of the tank and its turret, although essentially below water level, remained dry while the lower half, including the tracks and running gear, was immersed.

For trial purposes Straussler was given a redundant Tetrarch, or Light Tank Mark VII, from the 1st Armoured Division, which thus became the first Duplex Drive (DD) tank, and this is the odd thing. Anyone looking at the tank, in its amphibious guise, would be struck immediately by the canvas screen that effectively enclosed the upper part of it. This screen, with a slightly pointed bow and rounded stern end, was kept in shape at the top by a tubular rail but was raised and held upright by a series of rubber tubes, inflated with compressed air and held that way while the tank was afloat. Yet this strange screen and its amphibious capability formed no part of the tank's title. Duplex Drive simply indicated that it had two methods of propulsion: tracks on land of course but in the water a marine propeller.

A casual glance suggests that some sort of outboard motor was fitted to the Tetrarch, but upon closer inspection it is more like a marine inboard/outboard, probably designed especially for the tank. The three-blade propeller, which faces forwards, is suspended below a gearbox arrangement from which a splined shaft extends into a tube at the rear of the tank that is driven from the tank's gearbox. When the Tetrarch is on dry land this drive is disengaged and the outboard part held at an angle, but for entering the water it is swung into an upright position, when the two drive components meet. A flexible shaft, running from the top of the outboard to a position on the right side of the turret, controls steering, pivoting the outboard's lower section with a screw handle.

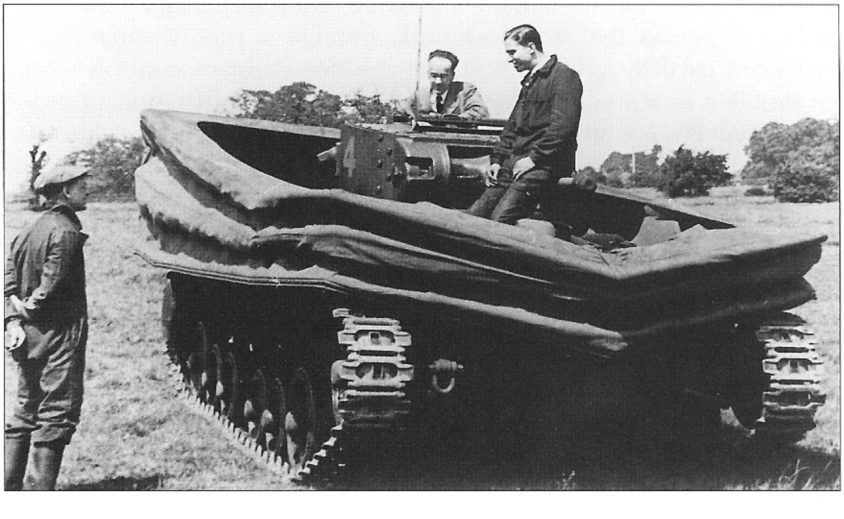
The little tank took its first official dip in Hendon Reservoir in London in June 1941. General Sir Alan Brooke witnessed the display, and soon gave the go-ahead for further development. Later the tank went to Portsmouth and did some saltwater flotation trials from the beach at Hayling Island, but it can only have been suitable for calm sea conditions. The screen itself was waterproof enough, being made from a rubberized canvas fabric produced by the P.B. Cow company, makers of the Lilo inflatable air bed. Even so it did not offer very much freeboard and was probably not sufficiently rigid to hold up in rough conditions.

THE VALENTINE

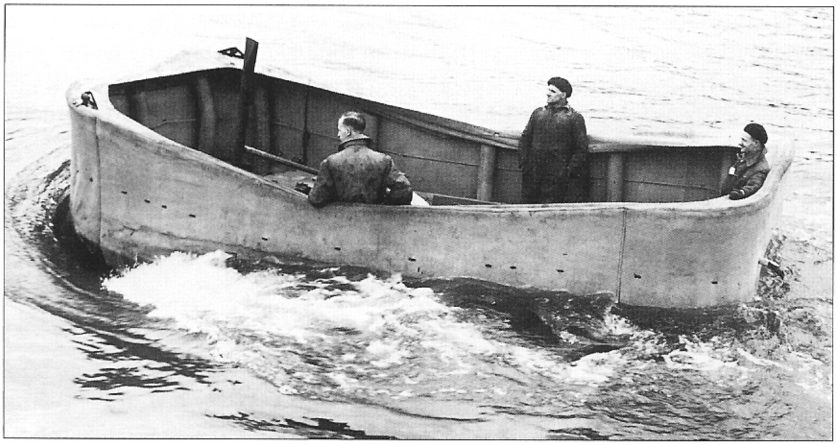
At the Fourth Meeting of the reconstituted Tank Board, at Shell Mex House in London on 19 September 1941, it was agreed that following the successful application of Straussler's principle to the Tetrarch it should now be tried on the Infantry Tank Mark III, or Vickers-Armstrong Valentine to give its popular name. It was a sensible choice; in many respects Valentine was the coming tank. It was already proving to be far more reliable than many of its counterparts, it was due to be produced in considerable numbers and, on account of its unusual lower hull shape, angled not unlike the bottom of a boat in order to deflect mines blast, it had a slight tendency to float already.

However, a Valentine, fully laden, weighed more than twice as much as a Tetrarch. In terms of displacement this was no problem – one simply enlarged the flotation screen – but trials with the prototype (Valentine II T16518) revealed that the air-filled tubes alone were not adequate to support the screen. To give the tank sufficient buoyancy Straussler doubled the height of the screen and introduced another tubular strengthener midway up. From the point where it was attached to the tank, up to this intermediate point, the waterproofed canvas was double thickness and single above that. The additional weight on land or pressure from water when afloat required more support so the designer introduced four collapsible struts, two each side, which locked both of the framing tubes into place.

Now that production had been agreed, a more practical means of operating the propeller from inside the tank was introduced. Drive still



A very early Valentine DD, quite probably the prototype, with its screen partially raised and attended by people who could well be members of Straussler's staff. The tank itself is an early example running on the lubricated, double-pin tracks.



An early Valentine DD afloat. These first examples have a characteristic dip in the middle of the screen, and on this one the driver appears to have an extended periscope to view over the screen. The studied nonchalance of the rest of the crew suggests very calm water.

involved a rearward extension shaft from the back of the transmission, passing through the rear of the hull and ending in a ratchet clutch that engaged another shaft to which a three-bladed propeller was attached. The difference was that on the Valentine the propeller was simply pivoted on a bracket and raised or lowered as required. The cumbersome semi-outboard arrangement on Tetrarch was eliminated.

The Valentine was a simple and reliable tank, but the additional equipment needed to make it swim required more careful maintenance because once it was afloat there was a lot more at stake. The Mark II converted by Straussler was powered by an AEC diesel engine, carried a crew of three and was armed with a 2-pounder gun and co-axial Besa machine gun.

Preliminary trials of this first Valentine DD were conducted on 21 May 1942, but under whose auspices and where are not clear. It was reported that the tank's hull, an old one, leaked but that it floated well enough on calm water and remained on an even keel. It appears that on this tank the controls were shared by the driver and the loader; the latter was either in the turret or 'on deck' since there is room for just one in the cab. The loader was, in effect, the helmsman, while the driver, besides controlling the engine and gearbox, could engage or disengage the propeller. Four days later Headquarters Combined Operations was pressing for the tank to go to Portsmouth for landing craft trials, but it seems that somewhere over that period the tank had sunk, because a report states that it had been partially stripped and that the non-standard controls would be installed in a second vehicle. In the meantime a decision to order production was put on hold. In fact the sinking may have been deliberate, since the subsequent report refers to a trial 'recently undertaken' in which two Bren guns were fired at a DD tank at ranges between 800 and 1,500 yards (731 and 1,371m) and resulted in the tank sinking.

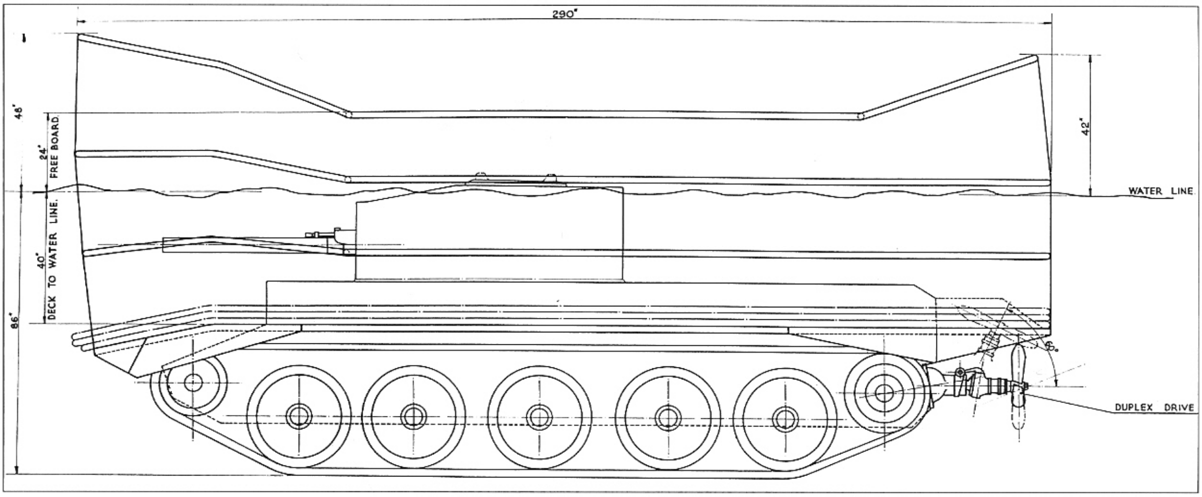
The second prototype, as it is described in this report, was T27661, another Valentine II. However on 16 June 1942 it is stated that a Valentine V (GMC diesel) was earmarked to go to Straussler's Royal Park works, which suggests that this was a replacement for the first prototype, and that the second was an entirely different vehicle. Whatever the case, things must have looked promising because on 3 July 1942 it was announced that the Ministry of Supply had given financial approval for the manufacture of 450 Valentine DD tanks, all with the GMC engine; 214 with the 2-pounder gun in a three-man turret and 236 with the 6-pounder in a two-man turret; 200 to be ready by the final quarter of 1942, the other 250 by the end of the first quarter of 1943. These details are confirmed by the Royal Armoured Corps' (RAC) six-monthly report for the first half of 1942, which adds that sea-going trials were being undertaken 'at the present moment'. It is probably worth pointing out that at this time the idea of a major invasion of the Continent was by no means popular with the authorities, and in the second half of 1942 the General Staff issued a policy statement on amphibious tanks that quite simply said that they had no requirement for such a thing. The idea of using such tanks as the first wave in a large-scale invasion was not on the cards.

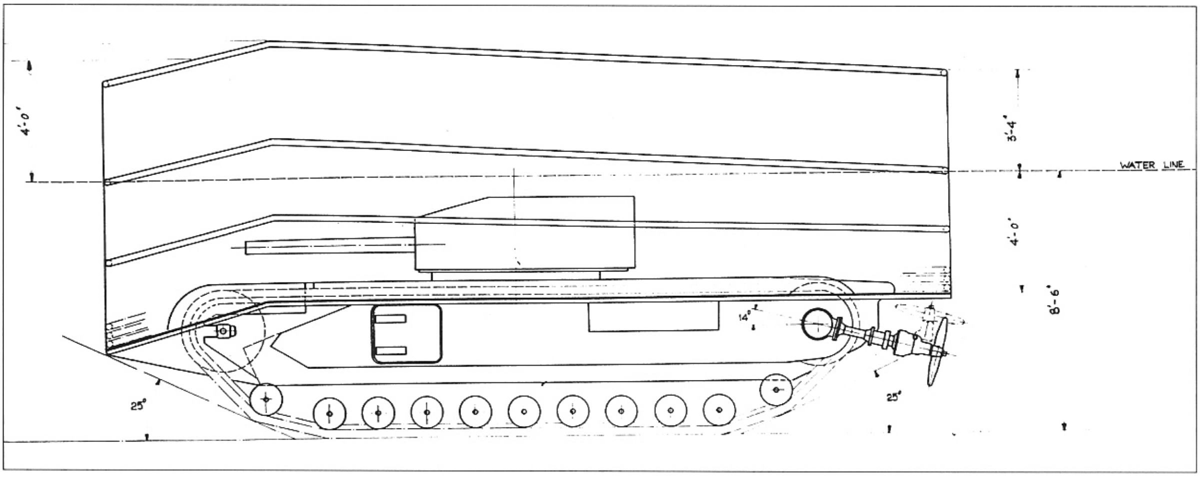
The contractor for all Valentine DD tanks was Metropolitan Cammell Carriage and Wagon Company of Birmingham, a firm partly owned by Vickers and popularly known as Metro-Cammell. Yet it is interesting to note that special contracts do not appear to have been issued. To judge from known War Department (WD) numbers, the Valentine DDs were simply selected from two large contracts for conventional tanks. The only other thing the two contracts had in common is that they were all for tanks fitted with the General Motors (GMC) diesel engine imported from the United States. DD production was scheduled to begin in March 1943 at the rate of 35 per month.

It is around this time that mention is made of a Cromwell DD and later still a Churchill. Drawings for both survive and show twin prop arrangements at the rear. In the event neither was adopted, almost certainly because the authorities could see that both tanks had a long period of development ahead of them before either could be regarded as reliable.

Early in 1943 the Department of Tank Design had carried out further firing trials against a floating DD tank that had been strengthened by fitting extra support struts. Apparently it survived, even with the range down to 700 yards (646m), although it was still regarded as vulnerable. By the summer of 1943 it seems that quantities had been adjusted: down in the case of 2-pounder tanks to 135 and up in respect of 6-pounder tanks to 430. The RAC also reported a requirement for a DD version of the Sherman, a prototype of which would be ready shortly.

Straussler's patent drawing for a proposed Cromwell DD, which would have had twin propellers driven off the transmission.





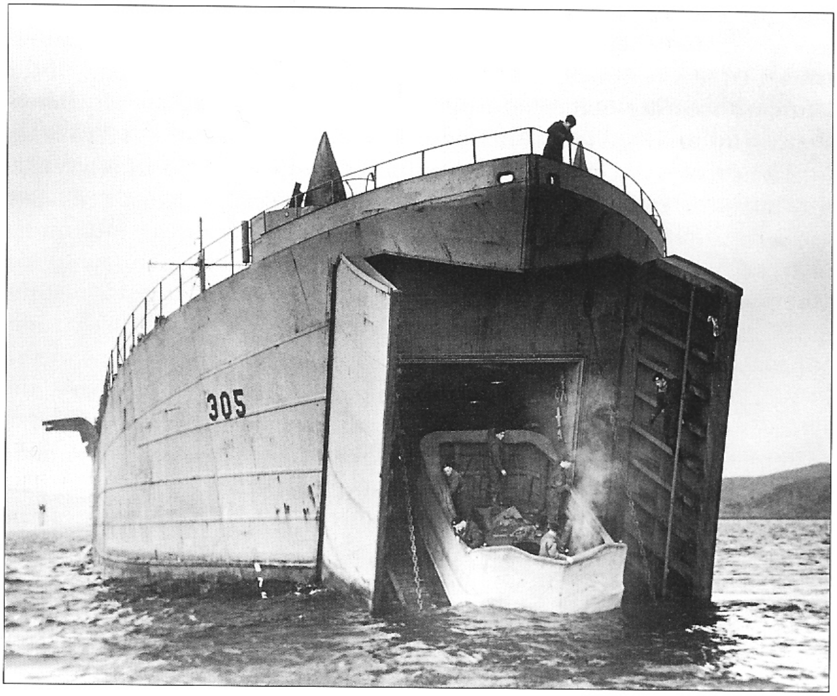
The proposed Churchill DD reveals a much-enlarged screen to cope with the additional weight and a far more complex method of powering the propellers, seemingly from the final drive.

Meanwhile production of the Valentine DD was proceeding and it was time to consider what to do with them. In April 1943 the 79th Armoured Division and its abrasive commander, Major-General Sir Percy Hobart, learned that in future they would take over responsibility for the development and employment of most types of specialized armour – the so-called 'Funnies'. In the main this simply meant taking existing organizations under one command, but the DD tanks were something new so it was agreed to convert the division's 27th Armoured Brigade to the role. Thus 4th/7th Dragoon Guards, 13th/18th Hussars and the East Riding Yeomanry handed over their existing tanks and moved to East Anglia to commence DD training. At this stage, it seems, the plan was to make every regiment fully amphibious but this would change, as would many other things, before they joined battle. From May 1943 they commenced training on Valentine tanks and began to receive DD variants the following month. Initial amphibious training was conducted on freshwater lakes at Narford and Fritton in Suffolk. The latter was the main DD training school, run by Canadian Army staff under the 79th Armoured Division.

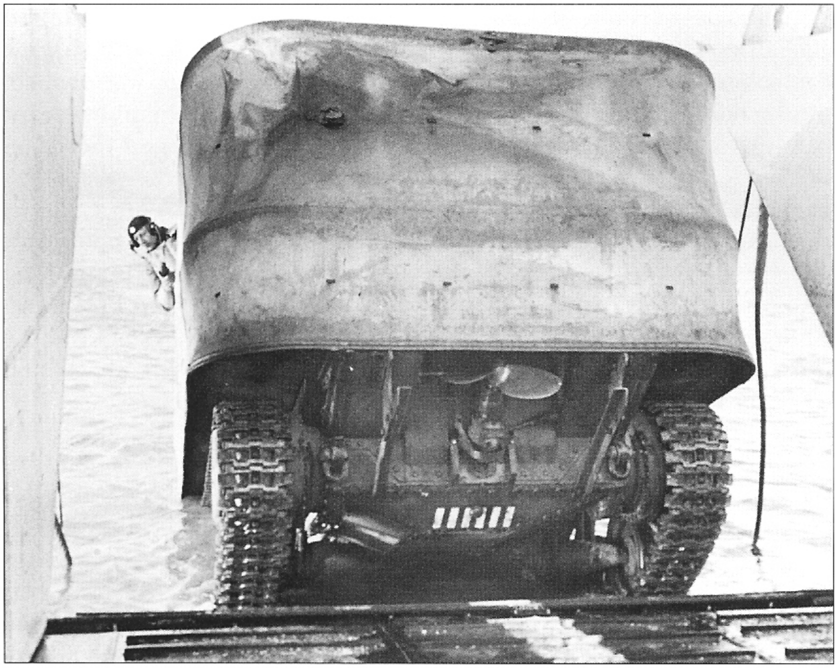
All this while the Valentine tank itself was evolving. Two-pounder (Valentine V) and 6-pounder (Valentine IX) versions have already been noted, but in 1943 a new 75mm gun was introduced that provided tanks with the ability to fire respectable high-explosive rounds in addition to armour-piercing. In truth the gun was not really new; it was the 57mm 6-pounder reamed out to 75mm and modified to chamber American 75mm ammunition as used in the Sherman. Since it hardly affected the tanks at all it was easy enough to convert them but even so the Valentine, approaching obsolescence by this time, was the lowest priority. However, as it happened it affected DD production. An RAC report from the summer of 1944, looking back over the previous six months, stated that total production of 2- and 6-pounder DDs would run to 365 tanks while the 75mm Mark XI DD would be produced to the number of 260. The report went on to state that those tanks with the smaller guns would be used for training purposes, that 75 operational and 30 training Mark XIs would be delivered to the Italian theatre and the rest apparently to South East Asia Command for use in the Far East. Figures released in December 1944, when production was complete, show 137 Mark V, 198 Mark IX and 260 Mark XI in all.

Ultimately Fritton became the nursery of all American, British and Canadian DD regiments that took part in the North-West Europe campaign. To increase realism a section of Bailey Bridge was erected, jutting out over the water, with a landing craft ramp at the end by means of which tanks were launched upon the lake. Crews learned the basics of boat handling and the tricky ritual of escape should their tank sink at sea. This was probably the most difficult operation of all. Close by the lake at Fritton was a deep concrete reservoir, at the bottom of which, according to some veterans, was a complete tank. Surviving photos only show the upper hull of a Sherman surmounted by a turret without a gun, but this could have been another location. Either way the purpose was the same. A trainee crew would get inside the tank, take up their approximate stations and then wait while the entire structure filled up with water. Then, on an order, they would activate the life-saving apparatus, wriggle out through the appropriate hatch and rise gently to the surface.

The risk of drowning while going down with your tank was very real, not just for those inside but even those 'on deck' who were liable to get caught if the screen collapsed inwards. Thus it was vital that crews had the proper equipment and were adequately trained, which was the purpose of the sink-training structure. At first it was assumed that escape would be no more difficult than from a sunken submarine so tests were carried out with Davis Submarine Escape Apparatus (DSEA), which comprised an inflatable pack worn across the chest and a little reservoir of oxygen. In practice the DSEA proved too bulky, so a more compact device known as the Amphibious Tank Escape Apparatus (ATEA) was developed by the Siebe Gorman Company and proved far more suitable. Even so, many survivors still believe that what they were issued with was the Davis gear.



An early Valentine DD with the raised front screen launching from an LST(2) in the Kyles of Bute. This was no easy task, only possible in deeper water and therefore improbable in practice. The tank is obviously carrying more than its normal complement of crew; notice the soldier watching from half way up the port side door.



Viewed from aboard an LCT, a Valentine DD enters the water. The propeller is visible, ready to engage, but the commander is more interested in the safety of his screen. The stripes painted beneath the propeller at the back are a night driving aid.

Swimming the Valentine

In preparing their tank for a swim, the crew first had to check all joints below screen level and ensure that they were sealed. Next the turret was turned through 180 degrees and trained aft and the gun brought to full elevation, otherwise the gun was liable to foul the screen.

This done the driver now opened a valve, and air from a bottle stowed at the rear inflated the side tubes, which in turn steadily raised the screen. Next the supporting struts were locked in place with a good, hard kick and the bilge pump engaged. The pump was mounted on a bracket low down at the rear, and it worked by the simple expedient of a small, rubber-tyred wheel that was brought into contact with the drum of the left-hand steering clutch and worked by friction once it was primed, shifting up to 24 gallons (109 litres) a minute.

The driver now grasped a special lever and inserted it into a socket that enabled him to lower the propeller until the ratchet clutch engaged with the driveshaft extension. The driver selected first gear and, under orders from his commander, drove carefully down the ramp until the tank was afloat. Now he selected neutral and, while the tank drifted, moved the prop-elevating lever to another socket, which was the steering control. The reason for using the one lever for both operations was to avoid the risk of elevating the prop at any position other than dead centre, since it could be damaged. This procedure was adopted even if, as often happened, the commander took charge of steering from outside, using a temporary tiller bar that was stowed at the back.

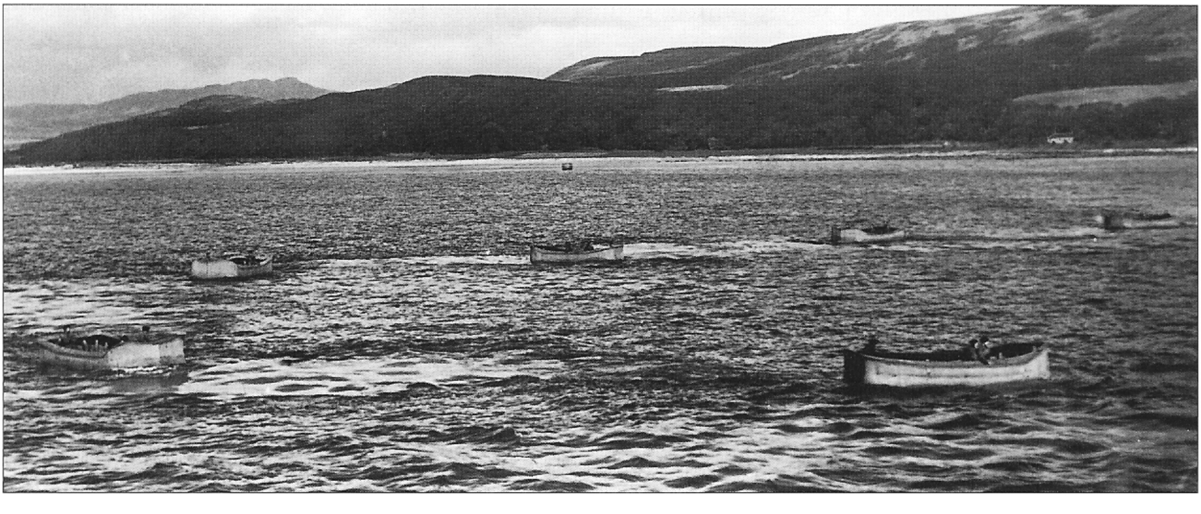
Once in the water the driver shifted into third gear and, holding the revolutions steady so that the speedometer showed 5mph (8km/h) (the tracks, of course, were still going round), proceeded to follow a course on his binnacle compass relayed by the commander. Among other things the instruction book for the Valentine DD speaks of a pressure-operated depth gauge near the front of the tank that was visible through the driver's periscope. Once it inflated the driver knew he was in water over 3ft (1m) deep and therefore effectively afloat. Some sources suggest that the 'inflatable bulb' was in fact a condom.

Once the commander had selected a suitable landing spot the driver manoeuvred the tank until it was square on and then brought the revs up to full speed, still in third gear. As soon as it was established that the depth of water was less than 3ft (1m) the driver slowed to disengage the clutch and raise the propeller. Then the air was released from the tubes and the screen collapsed. That done the turret was returned to the forward position and the tank was ready for action.

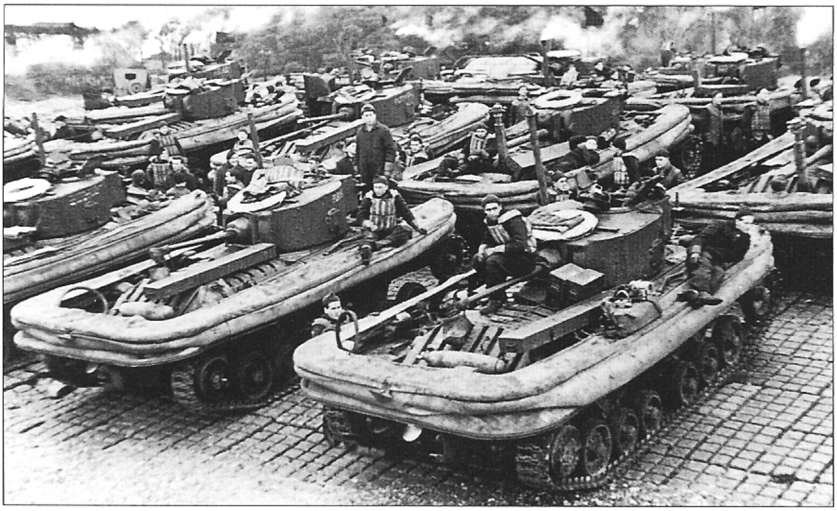
Down to the sea

From the calm, fresh waters of Fritton Lake crews now had to be trained at sea. A number of locations were developed, commencing with Inverary on Loch Fyne. This site on the west coast of Scotland had been selected as the Combined Operations Training Centre and the tanks set up their headquarters nearby at Castle Toward. From here they carried out training in the Kyles of Bute, a sheltered stretch of water near the island of that name. Another site was Fort George on Scotland's east coast where a number of exercises were held on the waters of the Moray Firth. Barafundle Bay, on the coast of South Wales, was also chosen because it was adjacent to an army firing range. It was here that various 'firing against' trials were carried out against unmanned DD tanks. On one glorious occasion a DD regiment, having swum their tanks ashore, were invited to line up along the water's edge and blaze away at the cliffs.

There were two important sites in the south of England. The sheltered waters of the Solent, separating the Isle of Wight from the mainland, proved to be an ideal training ground but for one thing. Tanks loaded on landing craft at Stokes Bay near Gosport and were launched to swim ashore in Osborne Bay on the island. One veteran recalls that if, during the passage, an Isle of Wight ferry got too close the crew had to stop the tank and drape a large canvas over the turret until it had gone by. The other location was Studland Bay, just outside Poole Harbour in Dorset. Here, among other things, was one of the special installations established to set the sea on fire in the event of invasion, which played a part in the trials, as



Valentine DD tanks manoeuvring off the Kyles of Bute on the west coast of Scotland. Notice how some of these examples have a prominent raised bow section of the screen. They have less freeboard elsewhere than the main production variant.



Stokes Bay, on the mainland side of the Solent, was the principal centre for training DD crews to work in conjunction with the Royal Navy. Here Mark V (foreground) and Mark XI Valentines DD wait, with turrets traversed, to back onto landing craft. Crews wear conventional life preservers while the tank carries one lifebelt. Note the air cylinders on the engine decks of the nearest tanks.

we shall see. But Studland Bay was also the site of a very unfortunate accident involving the 4th/7th Dragoon Guards on 4 April 1944.

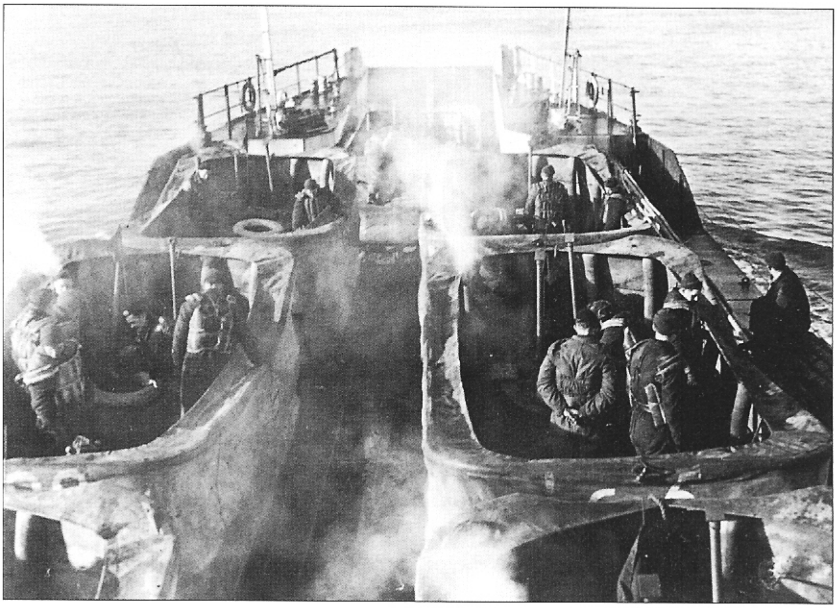
It is worth noting that the 4th/7th was still in Valentines at this time, although Shermans were also being used for training. Exercise Smash was a two-squadron landing in Studland Bay that began soon after dawn. No sooner were the tanks afloat than the wind got up, the sea turned rough and tanks began shipping water. Before long it was more than the bilge pumps could cope with and six tanks sank, taking six men with them. Others remained afloat but drivers were sometimes up to their waists in water before they reached the shore. Operational use of the Valentine DD was minimal and so closely linked to activities of Shermans that it can be covered later.

THE SHERMAN DD

The decision to adapt the DD programme to the Sherman tank was taken in 1943, and was a perfectly natural one given that the Valentine was past its prime by then and the Sherman was effectively the main battle tank of all the western Allies from this time. The programme remained essentially a British project, although the Americans had expressed an interest and would soon be gearing up to produce a version of the British design. In fact there remains a certain amount of confusion, even in original sources, about the types of tanks and quantities involved. For example the first mention of the Sherman DD in the RAC six-monthly reports – in this case for the second half of 1943 – states that there was a requirement for 100 Sherman V (M4A4) DDs and 593 Sherman III (M4A2) DDs.

Clearly at least one working prototype existed by then, since it was described as having been used in launching trials from the LST (Landing Ship Tank) 2 and the LCT (Landing Craft Tank) 2 with the result that both vessels were deemed unsuitable because their ramps were too short to ensure a safe launch. All of which seems to have been a bit of a waste of time, since neither type of vessel was destined to become operational in the future, and the RAC knew that.

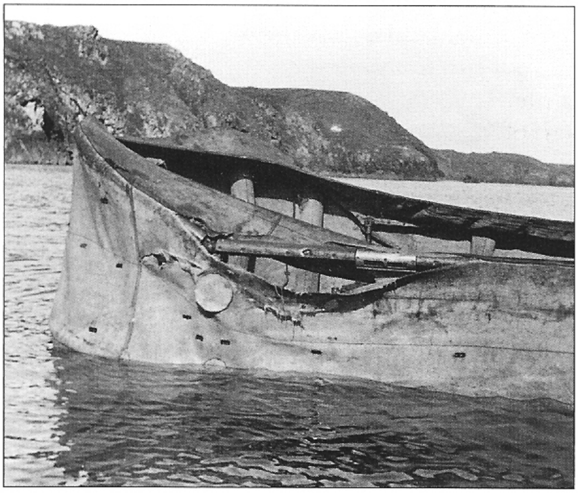
Screens raised and engines fired up, Valentine DDs prepare to launch from an LCT(2) in the Solent. Packed aboard like this it is difficult to move off, line up and launch without damaging the screen. These tanks feature a new type of driver's and commander's periscope.

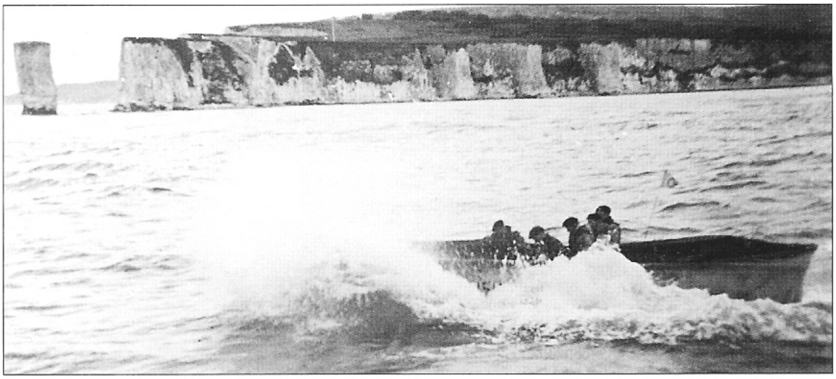


Six months later, but probably compiled well before D-Day, the report states that development of the Sherman IV (M4A3) DD and Sherman V DD were finalized and the tanks were now in service. Yet there is no evidence of a Sherman IV DD, and the M4A3 itself was rare in British service. It may well have been a prototype built for the Americans but this cannot be confirmed. Meanwhile, development of the M4A2-based Sherman III DD, the diesel version, was continuing. The results of flotation and cooling trials are described as satisfactory and it seems that on this version the propellers could swing upwards by 72 degrees, which was an improvement on the M4A4. Orders had been placed (with Metro-Cammell again) for just 293 Sherman III DDs while the requirement for the Sherman V DD had risen correspondingly to 400. A further statement reveals that the tanks would be issued to 'DD Brigades' on a scale of 15 tanks per squadron, but there is no explanation of what a DD brigade consisted of. The change in respective quantities appears to reflect problems in developing the M4A2 DD, but it is worth noting that production of the M4A4 had already ceased in the USA so the extra tanks would have to be drawn from British holdings.

The average weight of a basic Sherman tank was around 30 tons (30.4 tonnes) fully stowed, a substantial increase on the Valentine. To accommodate this weight the screen was enlarged yet again. It now stretched 7ft (2.1m) from deck to rim and was divided into three bands. The lowest part was three layers thick, the middle part two layers and the top just one layer. It is worth noting that in the case of the Sherman V DD, which had a longer hull and was the heaviest type, the additional canvas required to surround it provided additional buoyancy, causing the tank to ride about 1ft (30cm) higher in calm water.

'Firing against' trials were conducted off the rugged coast of South Wales. The screen is damaged and torn, exposing part of the frame, but in calm conditions such as this the tank is still afloat.



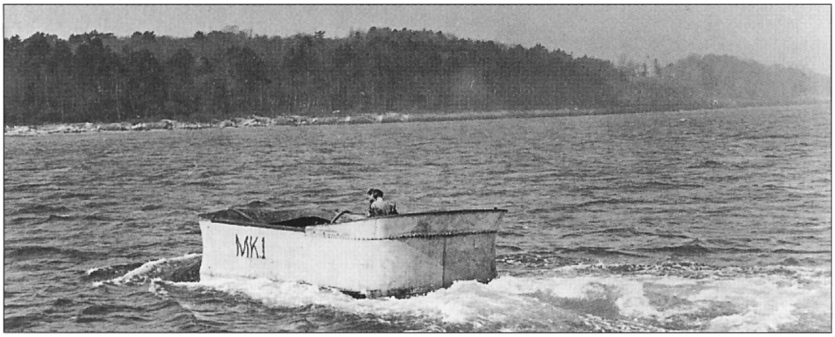


The chalk stack known as 'Old Harry' near Studland Bay in Dorset watches over the progress of a Sherman DD in quite heavy sea conditions. Why it should be heading out to sea is not so easy to understand. It was in these waters that the 4th/7th Dragoon Guards suffered their losses in April 1944.

Of course the Sherman, like all contemporary American tanks, differed from British types in the layout of its transmission. Gearbox and final drive and driving sprockets were located at the front, which posed a problem for Straussler and his design team. It was impossible to take the propeller drive straight from the gearbox, although the alternative adopted was quite ingenious. Two propellers were located at the back, beneath the rear overhang of the hull. They were driven from the tracks, via additional sprocket rings bolted to the idlers, which, in turning, rotated shafts through bevel boxes to the props. Ratchet clutches enabled the propellers to be raised clear when the tank was driven over land.

Steering the tank in the water was achieved by swivelling both propellers, either through a hydraulic system from the driver's seat or manually by a large tiller bar, operated by the tank commander, for whom a special platform was fitted to the rear of the turret, raising him high enough to see over the rim of the screen. Hydraulics were also employed to raise the propellers upwards and clear of the ground which, of course, also detached them from the drivetrain. Note that in the Sherman the driver was not expected to use the same lever to steer the craft and lower the propellers. One other difference from the Valentine was the provision of an electrically driven bilge pump that ejected surplus water through a pipe situated close to what would be the starboard bow of the swimming tank.

Performance in the water was slightly better than that of the Valentine with a top speed of around 6mph (10km/h) but the greater weight, particularly suspended below the surface, tended to make the Sherman DD more sluggish in choppy weather so it did not rise to the waves quite so easily and therefore tended to ship more water. Even so,



In the calmer waters of the Solent a Sherman DD I, probably an M4A4 given the extra freeboard, approaches the Isle of Wight with Norris Castle visible in the trees. This version featured a stiffened upper rail and raised screen at the rear.

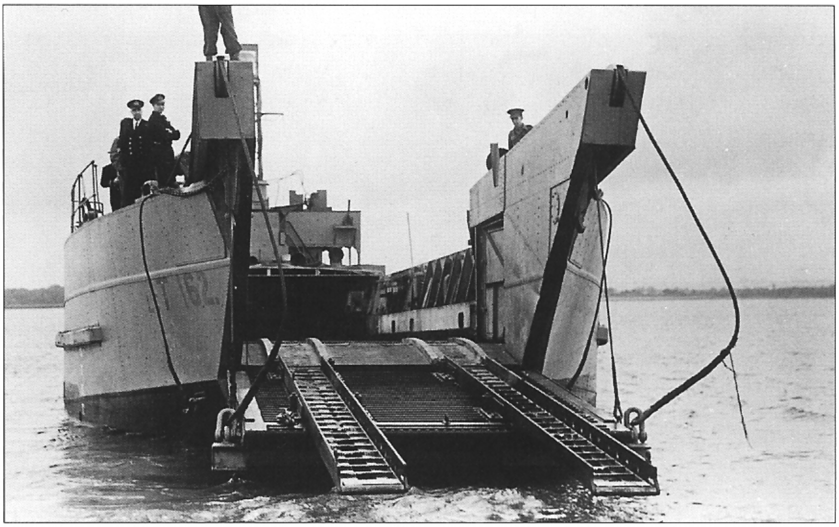
many writers remark on the fact that, once they became accustomed to it, the Sherman was easier to steer when afloat than one might expect from its shape.

Changes in organization

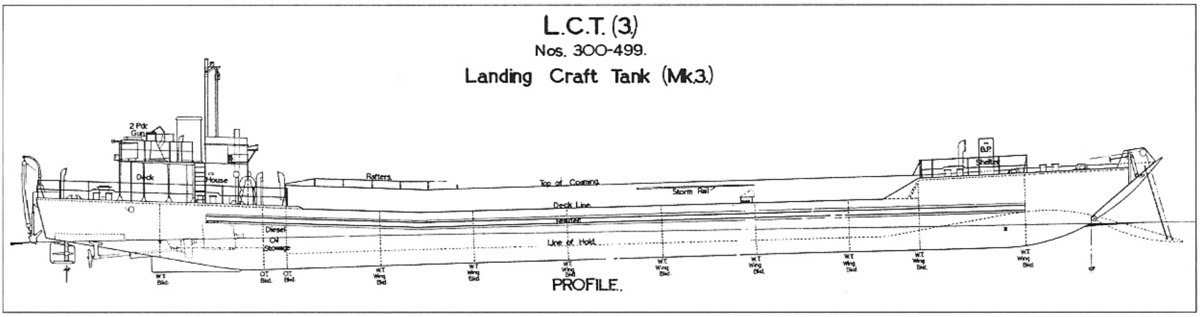
There appears to have been a diminution of interest in DD tanks late in 1943, but it is not clear what was driving it. At the outset it seems, or so the regiments believed, each regiment was to convert almost entirely to the amphibious role – three squadrons and regimental headquarters, only excluding reconnaissance troops and other ancillaries. Under the new system each regiment would nominate two squadrons for conversion to Duplex Drive, the remainder retaining conventional tanks. Whether this was due to a change in policy or a shortage of DD tanks is not clear, but the East Riding Yeomanry (ERY) thought they knew.

In February 1944 the ERY was told that it would hand over its DD tanks and revert to the normal role and it was claimed that this was due 'to a shortage of equipment', but this was belied by the fact that at the same time, the Nottinghamshire (Sherwood Rangers) Yeomanry took over its DD role. During the same period there was one of those curious organizational changes within the British Army that tended to baffle people at the time and have confused historians ever after. From February 1944 it was announced that the 8th Armoured Brigade would now comprise 4th/7th Dragoon Guards, 24th Lancers and Sherwood Rangers Yeomanry – the first and last being DD regiments. Meanwhile, the 27th Armoured Brigade, which would retain 13th/18th Hussars as its sole DD regiment, added the Staffordshire Yeomanry and retained the East Riding Yeomanry as conventional armoured regiments.

So was there a shortage of DD tanks? The answer seems to be yes, probably due to the delay in finalizing the design of the M4A2-based Sherman III DD and the requirement to supply DDs to the Canadians as well. It was solved when the Americans agreed to transfer 80 of their M4A1 DDs, which became the Sherman II DD in British service. Even so there are some curious inconsistencies. A 21st Army Group report allegedly showing holdings as of 30 June 1944 gives the following figures:



Since Landing Craft Tank (LCT) would be preferred for DD launching, trials were conducted with extended ramps, seen here on an LCT(2). They not only guided the tank through the narrow gap at the bow, but also launched it well clear of the leading edge of the ramp, which was always a dangerous moment.



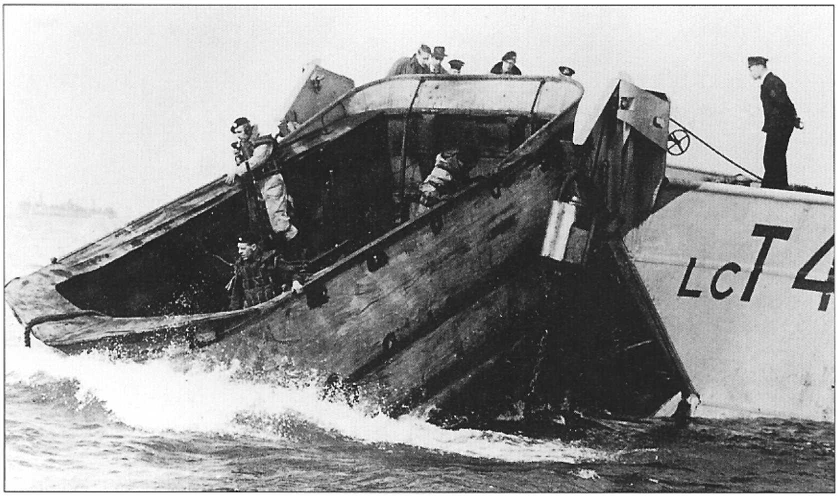
Side elevation on an LCT(3), the type that carried British and Canadian DD tanks on D-Day. This represents the first series of these craft, which were powered by twin Paxman diesel engines.

Sherman II DD	76 issued to 8th Armoured Brigade plus a reserve of four
Sherman V DD	76 issued to 2nd Canadian Armoured Brigade
	38 issued to 27th Armoured Brigade
	75 issued to 15th/19th Hussars
	57 reserves

The Sherman III DD does not appear anywhere in this table.

Ignoring 15th/19th Hussars for the present, what was the establishment of a DD-equipped regiment under the British system in 1944? According to a table published by the 13th/18th Hussars a DD squadron comprised a squadron headquarters of four DD tanks plus four troops, each of four DD tanks – that is 20 DD tanks in all per squadron, 40 per regiment. And just to complete the picture regimental headquarters had four Shermans described as wading, to distinguish them from DD, and a wading squadron with four tanks in squadron HQ and four troops each of three 75mm and one 17-pounder (Firefly) Sherman tanks.

The picture this table paints is of all five regiments short of establishment by two DD tanks at this time. Photographic evidence, for what that is worth, seems to bear out the distribution as listed above, so that any image of a Sherman II DD in British service should show a tank of 8th Armoured Brigade. If the tank is a Sherman V DD then it should be 13th/18th Hussars if it sports a large, two-digit number on the turret; if not, then it is Canadian: 6th Canadian Armoured Regiment (1st Canadian Hussars) or 10th Canadian Armoured Regiment (Fort Garry Horse). The



A classic view of a Sherman DD launching from an LCT(3). This was the dangerous time: one could easily rip the screen on projecting parts of the landing craft or crash back into the ramp after launching, due to the action of the sea.

three American DD battalions, the 70th, 741st and 743d, would all have M4A1 DD tanks, many of which would have an improved hull casting with larger overhead hatches for the driver and radio operator. These were assembled at the Lima Locomotive Works in Ohio from DD kits supplied by the Firestone Tire Company.

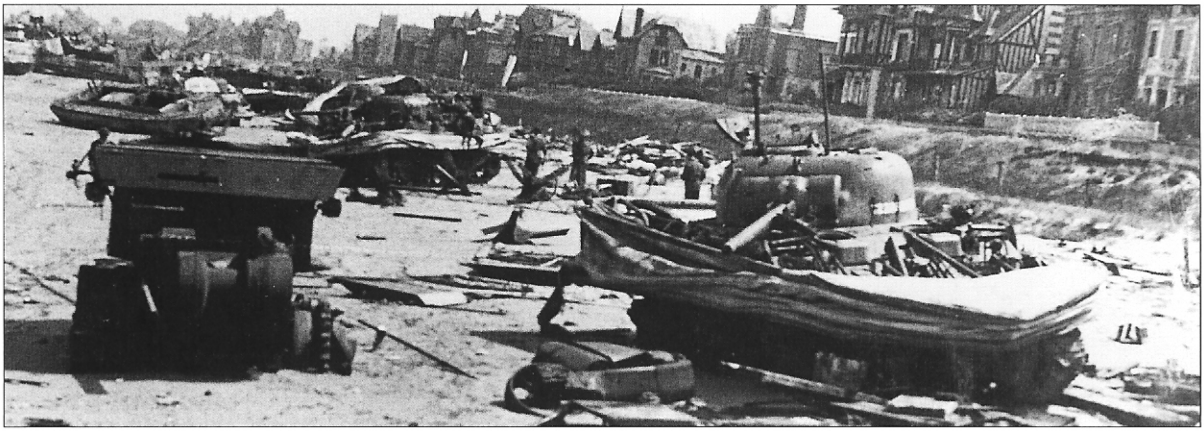
Landing craft

Two classes of amphibious warship are linked with the use of DD tanks when operating from the sea. These were the LCT, or Landing Craft Tank, and larger LST, the Landing Ship Tank. Of the latter, as we have seen, the LST(2) proved difficult to launch from, but in any case there was a different problem affecting the Sherman DD. It was simply too tall to pass through the bow door section when fully inflated and the alternative, of driving onto the outer ramp with the screen half raised, and then inflating at the next stage, seems fraught with difficulty.

This failing was remedied with the subsequent LST(3), but it came too late to participate in the Normandy landings. Meanwhile, in conjunction with the Royal Navy experiments were conducted off the Kyles of Bute to examine the possibility of transferring tanks from LST to LCT at sea. This procedure involved having the two vessels come together bow to bow with their ramps down and then driving the tanks, with their screens folded, from the larger to the smaller ship. Presumably the idea was to take advantage of the greater carrying capacity of the larger ship and its better seaworthiness to undertake voyages, while the LCTs acted as ferries off the invasion beaches. However, there would appear to be a problem in that once aboard the LCT the DD tanks would all be facing the wrong way and neither the Valentine nor the Sherman had the facility of a neutral turn; they certainly could not launch backwards. It goes without saying that this operation could only be conducted in a flat, calm sea.

As mentioned earlier, of the smaller craft the LCT(2) had already been rejected as unsuitable for DD tank work so the longer LCT(3) was selected instead. In its normal role the LCT(3) was capable of carrying nine Sherman tanks and in the early days of training Valentine DD tanks were packed aboard like the proverbial sardines. However, the importance of getting DD tanks into the water without damage to the screens led to the practice of carrying just five DD tanks on British and Canadian craft. These would be arranged herringbone fashion on deck. The Americans used the

Two abandoned DD tanks share Sword Beach at Lion-sur-Mer with other debris from the great storm. These tanks are from the 13th/18th Hussars and feature the brigade insignia and arm of service markings on the mantlet, a practice that appears to be unique to this regiment.



shorter and wider LCT(5). Incidentally, note that the Americans carried just four DD tanks on each LCT and it is assumed that the five per craft practice adopted by British and Canadian regiments included one DD tank from squadron headquarters with each troop.

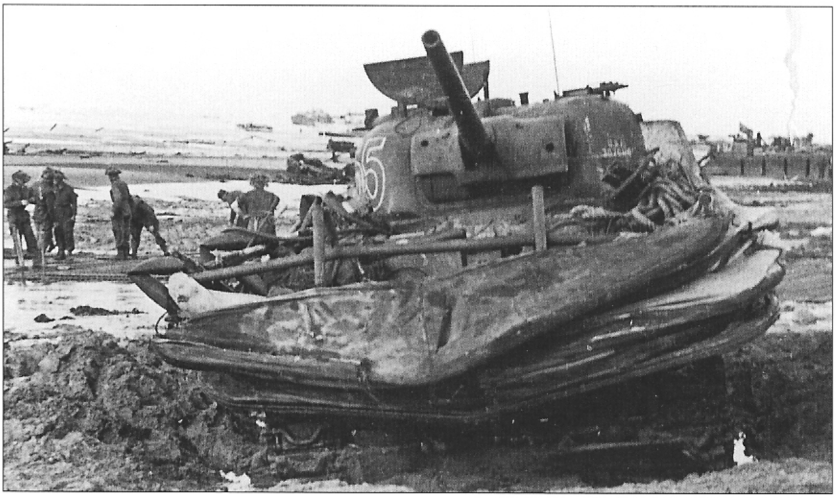
COMBAT HISTORY

Sword Beach

The wind was blowing steadily, Force 5 from the west. All night long the LCT(3)s pushed on in line ahead, their square bows slapping into a succession of choppy waves. Tank crews, those not prostrate with seasickness, worked on their tanks. At some time, while it was still dark, each crew activated compressed-air bottles on their tank that inflated the black rubber tubes and up went the canvas screens to surround the upper hull and turret. Then the crews went around inside the screens and carefully locked the various supporting struts in place before settling down to await the dawn.

Each LCT, which was designed to carry nine ordinary tanks, tightly packed, had five of the Duplex Drive Shermans on board, since the DD tanks were bulkier than a conventional Sherman and needed more space to manoeuvre. Ten thousand yards (9,144m) from shore, the point marked by a midget submarine, the LCTs carrying the DD tanks of the 13th/18th Queen Mary's Own Hussars fanned out until they were in line abreast. At H-Hour minus 110 minutes Major Wormald commanding A Squadron received the order 'FLOATER' on LCT number 101. His second-in-command on 102, Captain Lyon, went around his crews and dished out a tot of rum. More air was blown into the support tubes and at 5,000 yards (4,572m), some 2,000 yards (1,828m) further in than the original plan called for, the LCTs rang down to stop engines and each craft dropped a stern anchor while the crew prepared to lower the ramp. The sea was a bit calmer here, but not much.

Ten minutes was allowed for the launch and one by one the tanks manoeuvred onto the centre line of the tank deck and eased forwards. This was the tricky bit: first each tank had to make its way carefully through

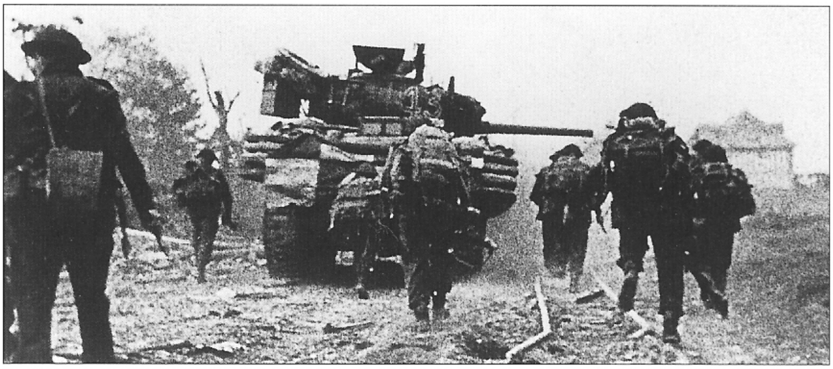


This Sherman DD of the 4th/7th Dragoon Guards made it ashore on Gold Beach, only to become trapped in a soft patch on the beach. Although it is not recorded elsewhere, this regiment appears to have used turret numbers for identification purposes, although a contemporary colour photograph suggests that these were just white outlines with no colour infill.

the narrow bow – touch either side and you would rip the canvas screen. Then you had to negotiate the ramp and slip into the water. According to the drill this was to be done in second gear so that the tank had enough velocity to drift clear of the ramp, but Wormald and Lyon had already agreed that their tanks would move off and stay in first, edging down the ramp with careful use of the clutch before taking the plunge. As each tank settled in the water and ensured it was clear of the ramp the driver lowered the two propellers and the unwieldy little craft started to get under way.

As his tank slipped down the ramp Major Wormald glanced at the shore; there, ahead of him he could make out the church tower at Lion-sur-Mer and calculated that his landing beach was 45 degrees off his port bow. At this time the shoreline was clear, but in a very short while it was obscured by shells from the warships behind him, by bombs from above and by more shells fired from self-propelled artillery on other landing craft. Very soon rockets from modified landing craft would also come roaring over to add to the noise and smoke. The major had absorbed a fair amount of nautical lore during training, and so had Captain Lyon, who was worried about the state of the sea: it had never been as rough as this during training. Lyon was most concerned about the effect of a beam sea – waves striking the sides of his tanks and swamping them – so he adopted a zigzag course to counter this. He remarked afterwards how well the tanks stood up to the conditions and was particularly pleased that a modification to the rear struts prevented them from collapsing under pressure. Struggling against the waves the flotilla of tanks formed straggling columns behind their pilot boats and headed for the shore.

Not that it went smoothly for everyone. The first tank to try and launch from LCT 467 tore its screen and since the others could not get past there were two options – either dump the afflicted tank in the sea or take the whole troop ashore and land dry, which is what they did. As the last tank but one plunged off LCT 465 the ramp broke and the landing craft was obliged to sail home with the fifth tank still on board. Meanwhile, the remaining tanks of A and B Squadrons were ploughing on through the waves. Glancing round Captain Lyon counted 19 tanks, all keeping good station, but progress was slower than the timetable called for due to the rough weather, and that was not all. Some 1,200 yards (1,097m) from shore, Lyon said, they were overtaken by other LCTs 'apparently steered by maniacs' that threatened to run them down. His squadron altered course to avoid them but Captain Denny's tank, from LCT 103, was hit and rolled over in the water. Denny was the only survivor.



Moving inland with infantry in support, this 13th/18th Hussars Sherman shows another unique feature, the chequered panel of white and blue/green squares draped over the back of the flotation screen, presumably with some special 'follow me' purpose.

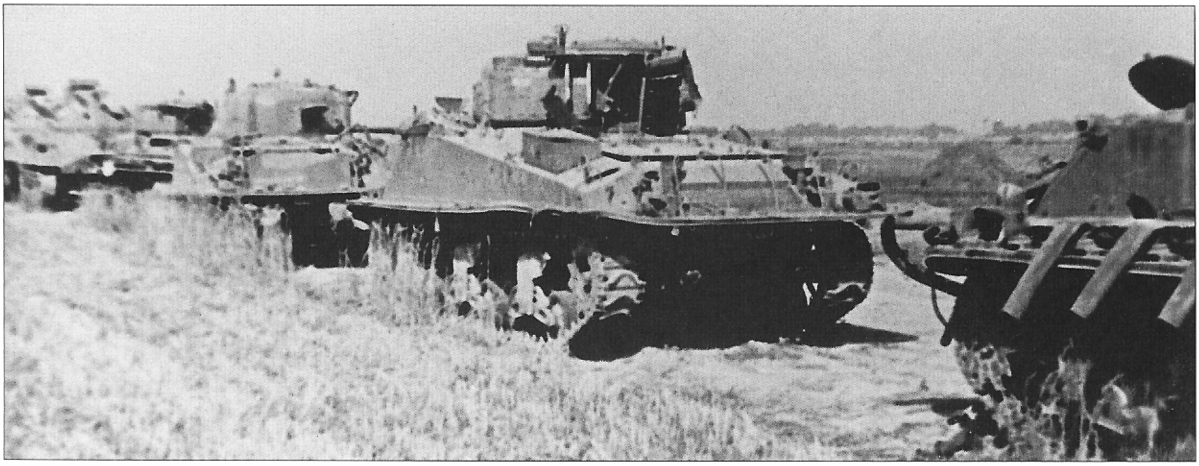
Minutes later the LCT(R) rocket craft opened up. Major Wormald estimated that 10 per cent of the projectiles fell short, in amongst the swimming tanks. Now the LCTs that had driven through them went astern, but the DD tanks were unable to stop and overtook the landing craft. At this point the DD tanks were supposed to spread out in line abreast but this did not prove so easy; at about 300 yards (274m) from shore the drivers felt their tracks bite on the sand – they had made it.

Operations *Neptune* and *Overlord*

The preceding passage describes the landing on D-Day from the point of view of the 13th/18th Hussars, but since D-Day was the action debut of the DD tank it seems reasonable to follow the fortunes of all eight regiments/battalions on this significant day. We shall begin at the opposite end of the invasion zone, off Utah Beach. The pattern of tidal movement in the English Channel means that the tide begins its rise from the west, so H-Hour here was 0630 hours. Even so the DD tanks of 70th Battalion were running some 15 minutes late due to the loss of a control vessel, and four tanks were lost prior to launching when their LCT was hit by enemy artillery fire. Although sea conditions were not too bad in the lee of the Cherbourg Peninsula, the DD tanks were carried in to within 1,000 yards (914m) of the beach; 28 tanks from the two DD companies launched and 27 swam ashore to a very mild reception. Confused by a massive smoke screen the leading infantry landed about 2,000 yards (1,828m) away from their objective and encountered relatively little opposition, so the tanks did not find a lot to do.

Further east, off Omaha Beach, sea conditions were much worse. Local fishermen claim that west of the Calvados Reef waves are shorter and steeper in certain conditions of wind and tide, and this was the situation on 6 June 1944. Indeed it looked so bad that it was agreed that landing craft carrying two companies of the 743d Battalion towards Dog Sector should finally sail all the way in and land them more or less dry. Just east, in the unfortunately named Easy Sector, DDs of the 741st Battalion launched at about 5,000 yards (4,572m) and created a legend that endures to this day. Twenty-nine tanks launched and were soon swept off course by the wind and tide. Struggling to regain their position, one after another they were swamped and plunged to the bottom until

Sherman V (M4A4) DD tanks, probably from one of the Canadian regiments, photographed well inland. The nearest tank still retains stumps of some rubber pillars; the next tank still has the special turret fittings while the one in front of that seems to have been more thoroughly stripped.

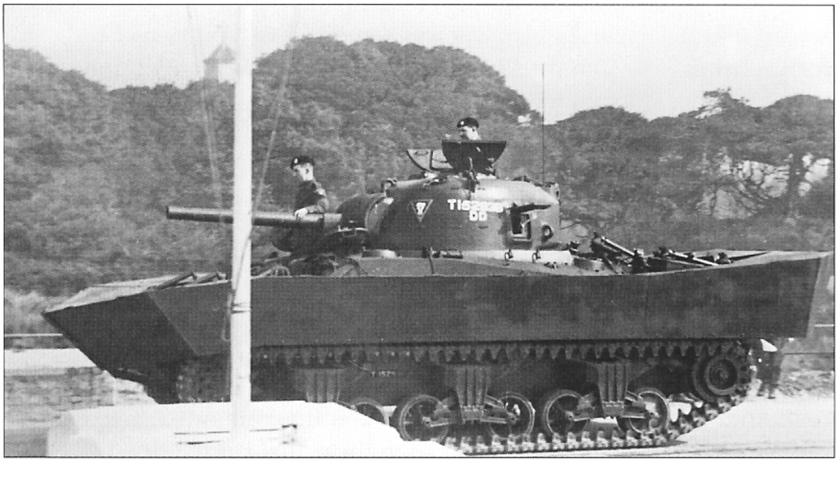


just two made it to the beach, joined later by three more that never launched. Men of the 116th Infantry, heading for Omaha in their landing craft, noticed dozens of men in the water, mostly in little orange dinghies, and assumed they were all downed aircrew. Only later was it realized that these were the survivors of the 743d.

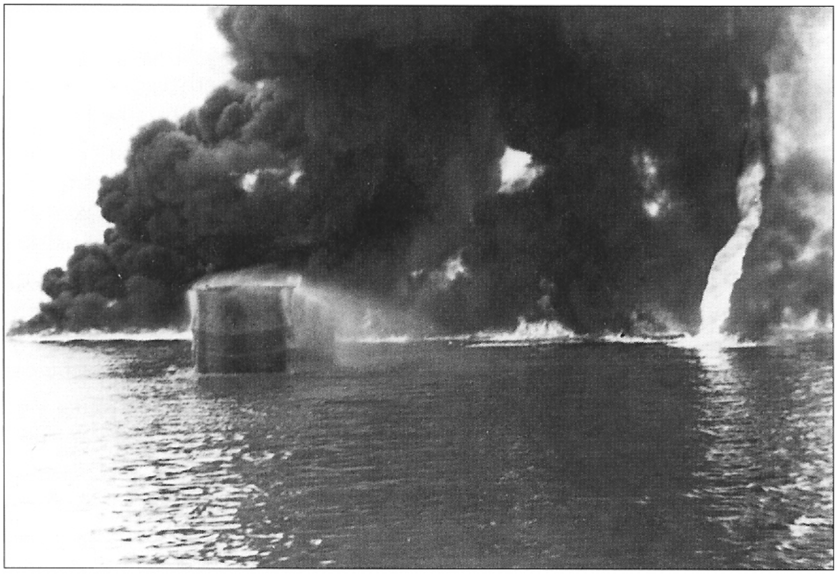
It has to be said that many American officers were very sceptical about the safety and effectiveness of DD tanks, and there is some justification for this. On the other hand where they did make it ashore the DD tanks did very good work, and those that reached Omaha gave an extremely good account of themselves while they survived.

Off Gold Beach, where H-Hour was 0725 hours, it was now the turn of B and C Squadrons of the Nottinghamshire Sherwood Rangers Yeomanry (SRY) to land on Jig Sector. Sea conditions were not good here so they launched at 700 yards (646m), but even so the two squadrons lost eight tanks between them. They were late in landing and in the interim Sherman Crab flail tanks of the Westminster Dragoons had been doing their work for them, taking out gun positions and machine-gun nests. However, it is interesting to note that in this case the SRY records that A Squadron and Regimental Headquarters (both waders) arrived about 90 minutes later. Immediately to their east the 4th/7th Dragoon Guards encountered similar conditions, so its senior naval officer decided to run them all the way in. The water was deep enough to justify raising the screens, but in essence the DD tanks of B and C Squadrons simply drove ashore through the breakers. Unfortunately, having made it to the beach a number of 4th/7th Dragoon Guards tanks were then trapped in patches of soft sand and were subsequently swamped by the incoming tide.

Next along the coast was Juno Beach where the 3rd Canadian Division was due to land, supported by two Canadian DD regiments. Here H-Hour was 0735 hours on Mike and 0745 hours on Nan Sectors and the former was to be assaulted by the DD tanks of A and B Squadrons, 1st Hussars (6th Armoured Regiment). On account of the sea conditions the A Squadron tanks were carried to within 1,500 yards (1,371m) of the shore where ten launched, of which seven actually made it while the remainder landed dry. B Squadron, on the other hand, launched at about 4,000 yards (3,657m), deployed at 2,000 yards (1,828m) and put 14 out of 19 tanks ashore.



Topee was a system of metal panels that enclosed a DD tank's screen while it was folded down, but which dropped away when it was raised. As the name implies it was intended for use in the Far East where, it was feared, dense undergrowth might otherwise tear the screen.



A protective spray with the uncompromising name of Belch was developed for the DD tanks that, with the aid of a pump, sucked up sea water and squirted it over the vulnerable screen as the tank sailed through a formidable flame barrage of oil, burning on the sea, at Studland Bay. The flame barrage had been established as an anti-invasion measure in Britain and there was a fear that the Germans might have something similar.

The Fort Garry Horse (10th Armoured Regiment) launched its A and B Squadrons much closer in, and although some claim to have used their propellers the majority simply had what they describe as a wet wade before deflating on the shoreline. Apparently the code word indicating that DD tanks had made it ashore was POPCORN.

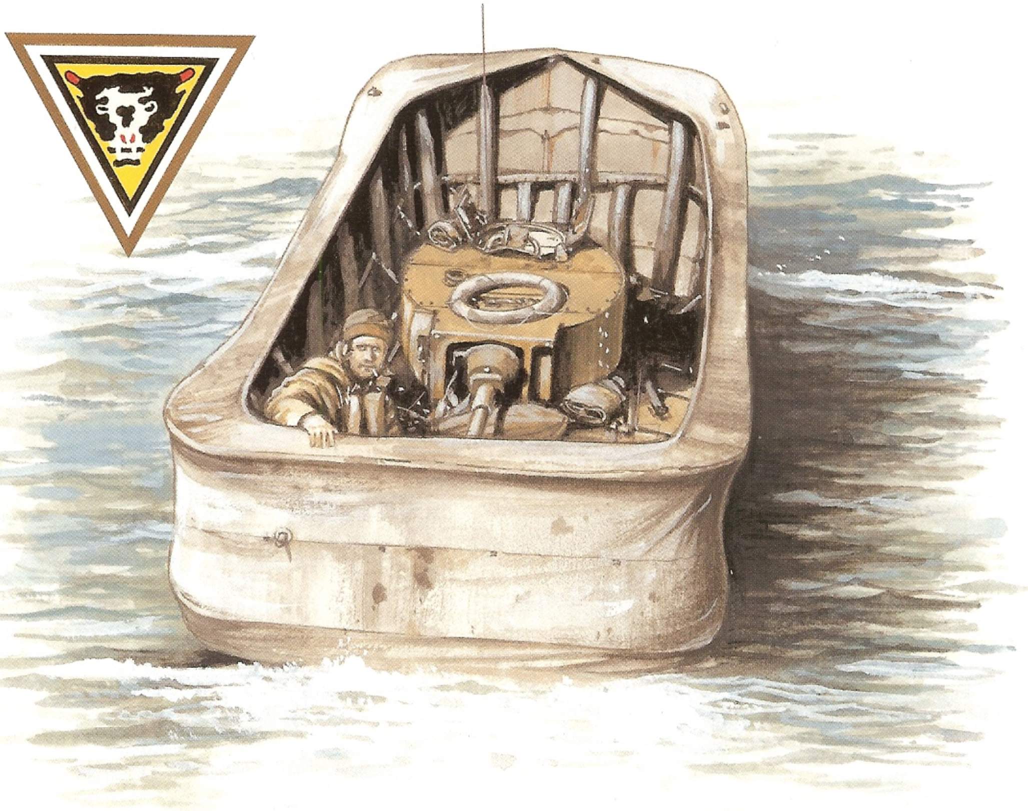
Of the 13th/18th Hussars on Sword Beach we already have an account. A and B Squadrons were in DD tanks and of their combined total of 40 tanks 34 took the plunge and 31 made it ashore. Casualties were few although once on the shoreline, and this seems to have been a common failing, the tanks were so absorbed in the business of picking and destroying targets that many failed to notice the encroaching tide and were swamped, although they kept firing until rising water made the turrets untenable.

There is one very curious feature of the 13th/18th, a practice that none of the other DD regiments appear to have adopted. Draped over the rear of the screen of each tank was a large fabric panel divided into a chequerboard pattern of eight squares, alternatively green and white, which showed above the surface when the tank was afloat. Once ashore, if the crew remembered to arrange it, the panel hung from the collapsed screen like an apron. Logically it was some sort of 'follow me' indicator for accompanying infantry, but no mention of it has yet been found and it is not even clear if it was specific to one or both DD squadrons.

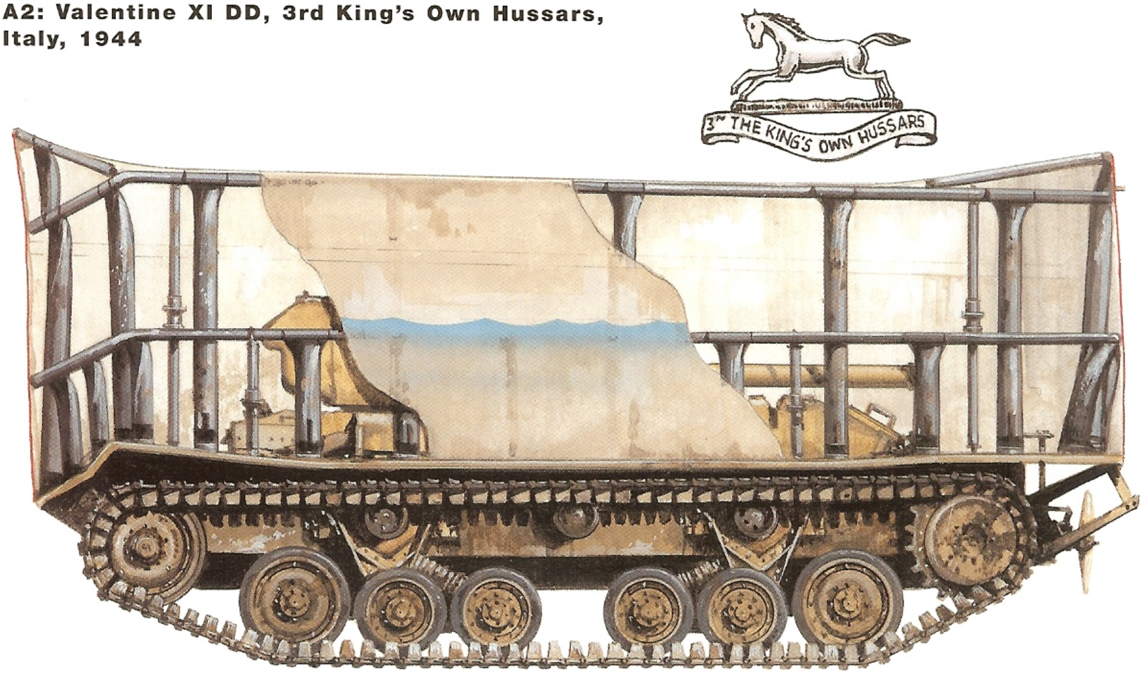
Depending on the situation ashore many tanks went quite a long way inland still sporting their folded screens. The SRY were certainly photographed passing through Bayeux in this state. However, as soon as there was time available most tanks had their screens removed, there being a fear that once the screen dried out it could be very vulnerable to flamethrowers. So off came the screens, air pillars, struts and propellers. Even so most crews tried to retain the lower decking, particularly at the front where it formed a useful tray for carrying extra stores.

And there we must leave them. Once ashore they fought as regular tank units and, when the DD machines had shed their amphibious apparatus, there was little to distinguish them from those that landed dry.

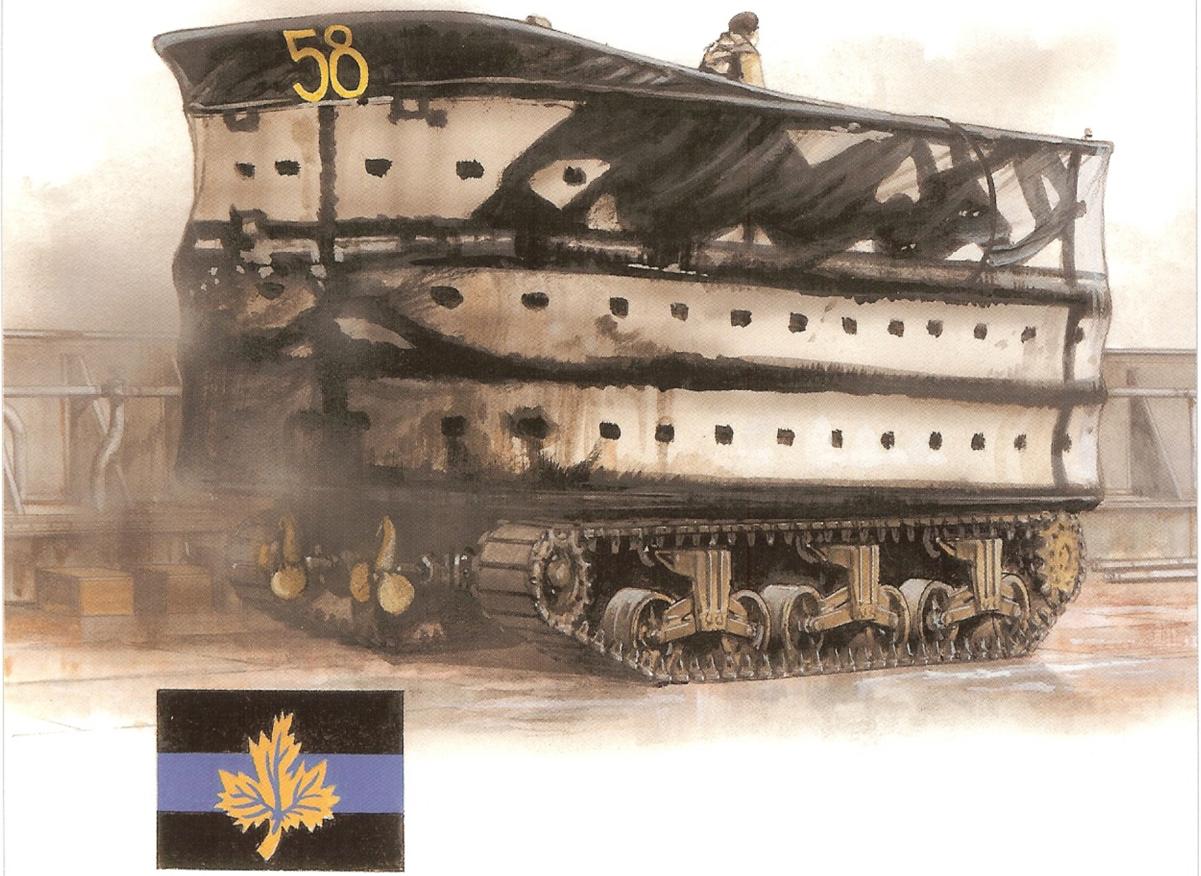
A1: Valentine V DD, A Instructional Wing, 79th Armoured Division, Fritton Decoy, 1942



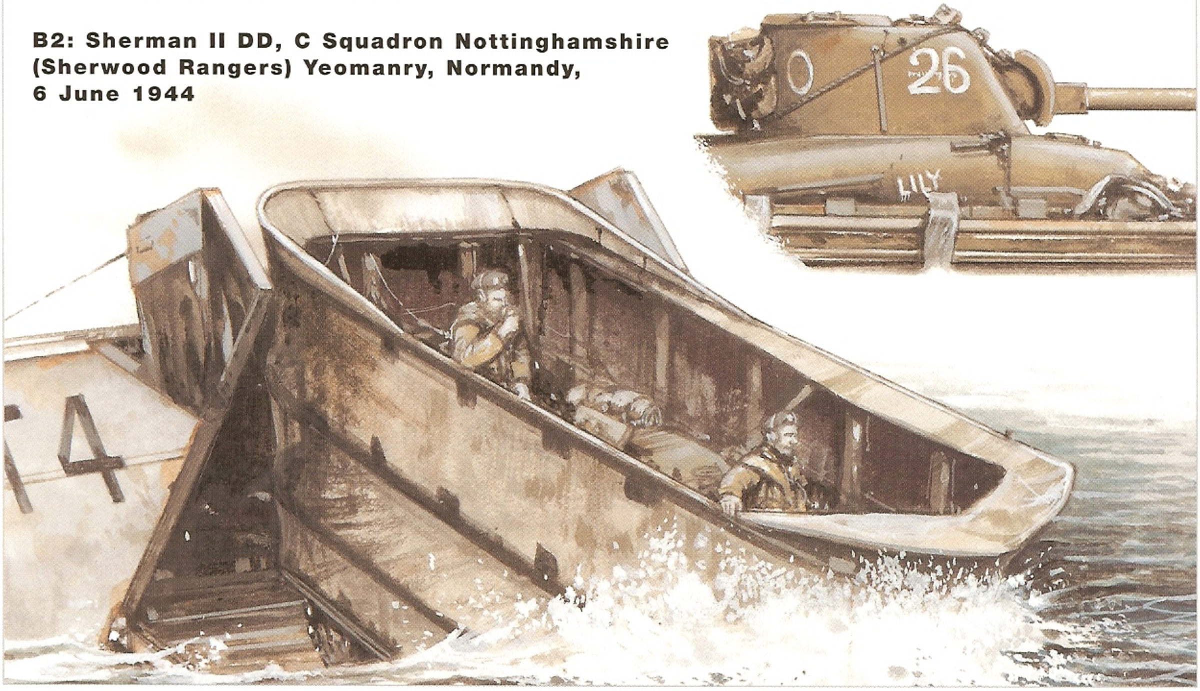
A2: Valentine XI DD, 3rd King's Own Hussars, Italy, 1944


3rd THE KING'S OWN HUSSARS

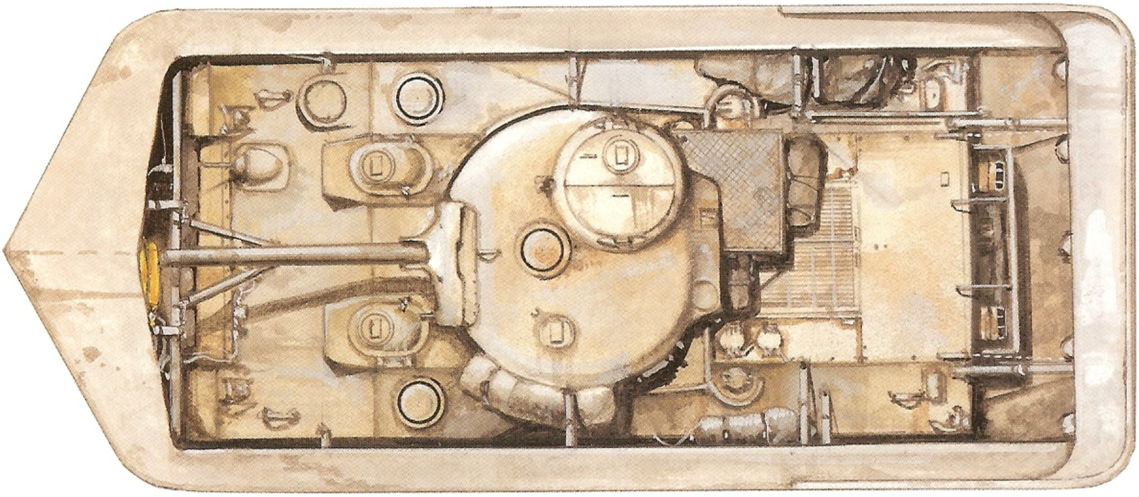
B1: Sherman V DD, 2nd Canadian Armoured Brigade, Normandy, 6 June 1944



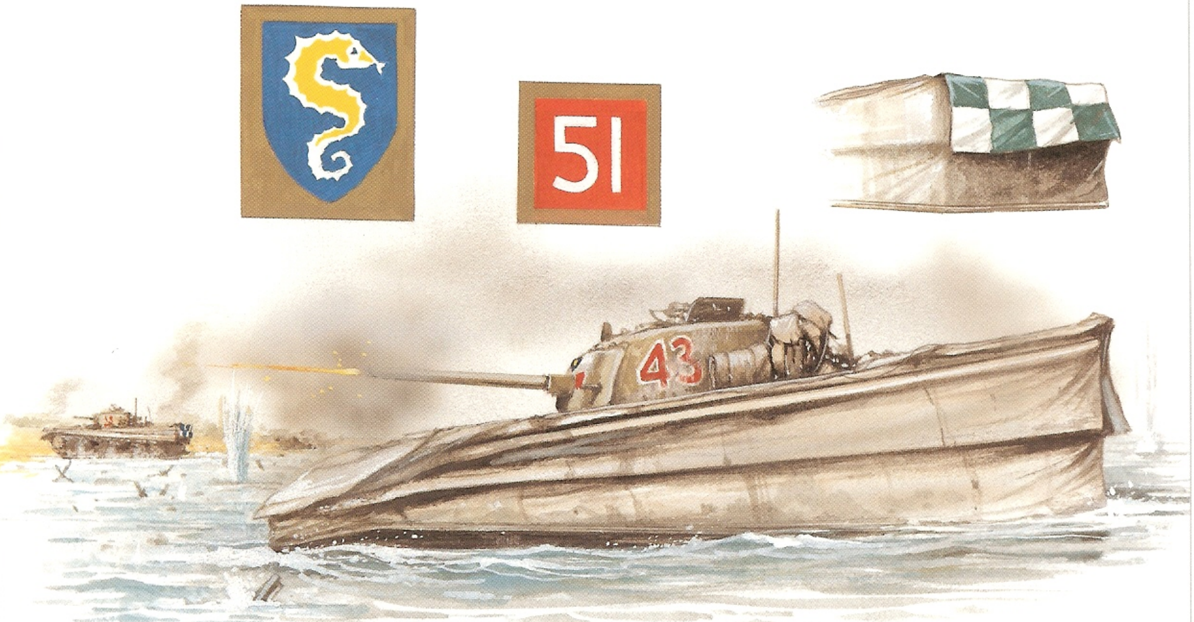
B2: Sherman II DD, C Squadron Nottinghamshire (Sherwood Rangers) Yeomanry, Normandy, 6 June 1944



C1: Sherman DD tank swimming, viewed from above



C2: Sherman V DD, A Squadron, 13th/18th Royal Hussars, Normandy, 6 June 1944

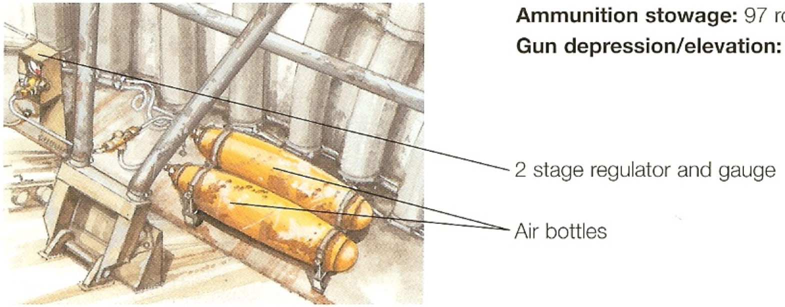


D: SHERMAN III (M4A2) DD

KEY

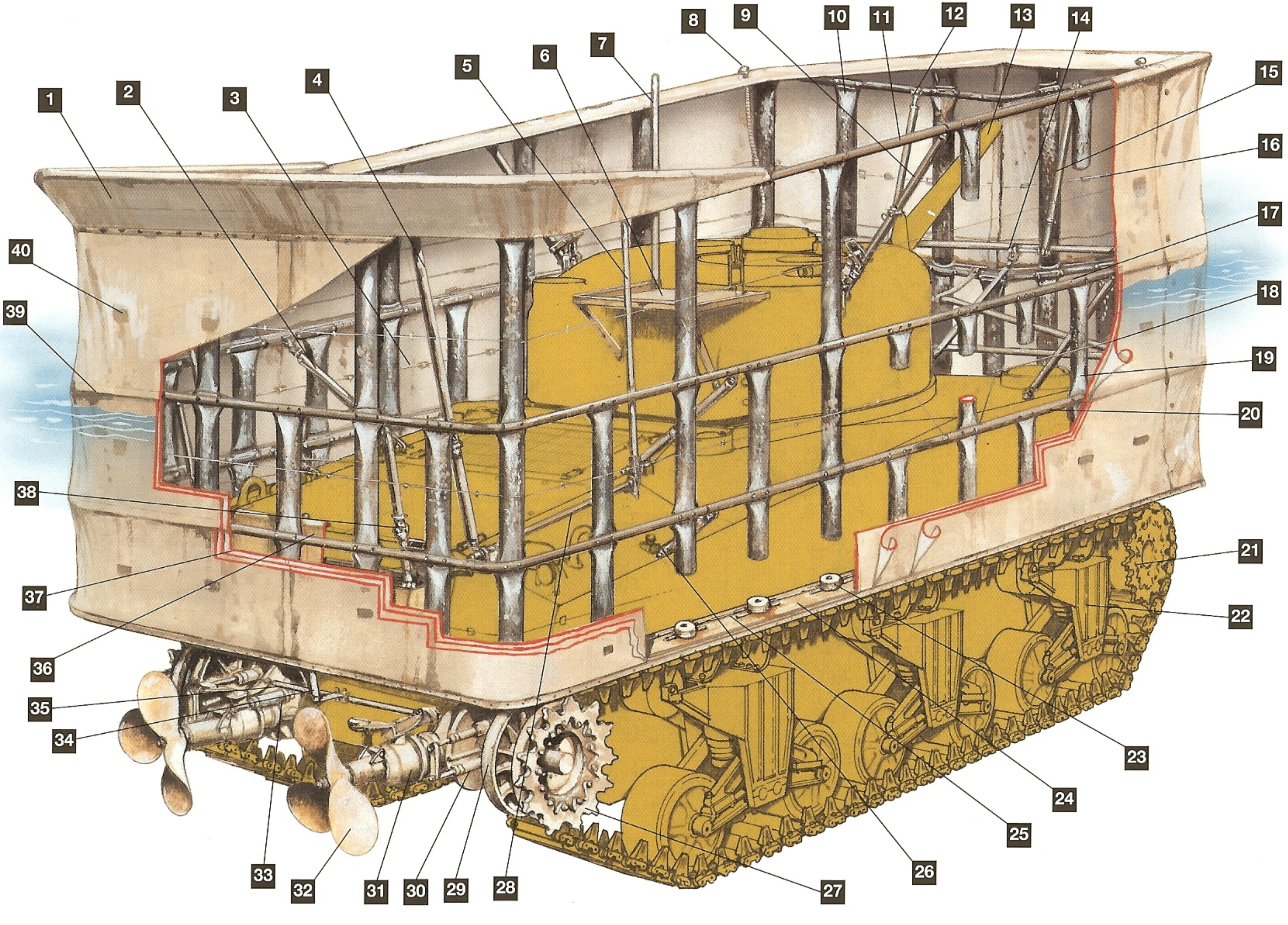
1 Raised section of rear screen
2 Intermediate support strut, left side
3 Screen tension cable
4 Full-length rear support strut
5 Commander's tiller
6 Commander's platform
7 Commander's support
8 Driving light left side
9 Turret support strut
10 Long rubber support tube
11 Upper screen rail
12 Upper front bracing bar
13 75mm gun
14 Lower front bracing bar
15 Front support strut
16 Upper flotation screen (single thickness)
17 Intermediate screen rail
18 Intermediate flotation screen (double thickness)
19 Short rubber support tube
20 Lower screen rail
21 Drive sprocket
22 Suspension unit
23 Air tube base
24 Screen base or deck
25 Air line
26 Hydraulic strut breaking cylinder
27 Rear sprocket ring
28 Steering shaft from tiller
29 Idler wheel
30 Track tension adjuster
31 Propeller drive housing
32 Starboard propeller
33 Propeller raising gear
34 Steering shaft
35 Steering tie rod
36 Internal exhaust screen
37 Bottom flotation screen (triple thickness)
38 Strut breaking knuckle
39 Sealed joint
40 Attachment points, rubber tubes to screen

AIR CYLINDERS



SPECIFICATIONS

Crew: 5
Combat weight: 34.5 tonne
Power-to-weight ratio: 10/7 hp/ton (Imp)
Overall length: 7.31m
Overall width: 3.2m
Overall height (screen raised): 3.8m
Engine: General Motors 6046, 12 cylinder twin-in-line diesel 410hp @2900rpm
Transmission: 5 speed & reverse, controlled differential steering
Fuel capacity: 560 litre
Max. speed, land: 48 km/h; **water:** 8 km/h
Max. range: 241km
Fording depth: 101cm
Armament: 75mm M3, 2x M1914 .30 Browning machine guns
Ammunition: AP, HE, smoke
Muzzle velocity: 618.7 metre per second
Max. effective range: 9,738m
Ammunition stowage: 97 rounds
Gun depression/elevation: -10 deg./+25 deg.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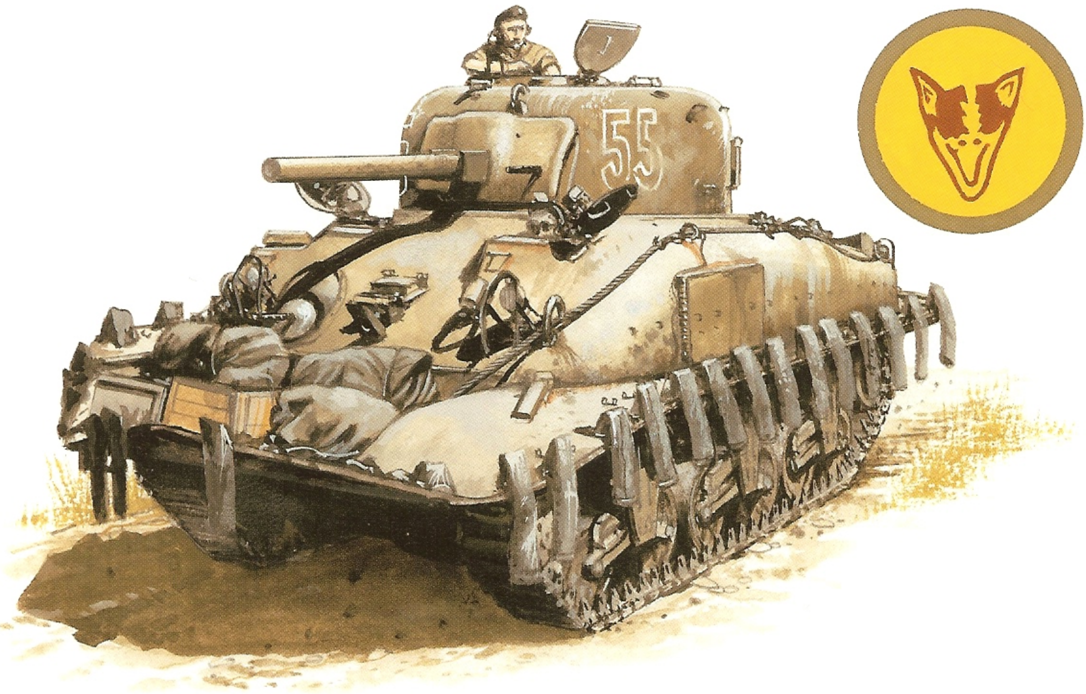
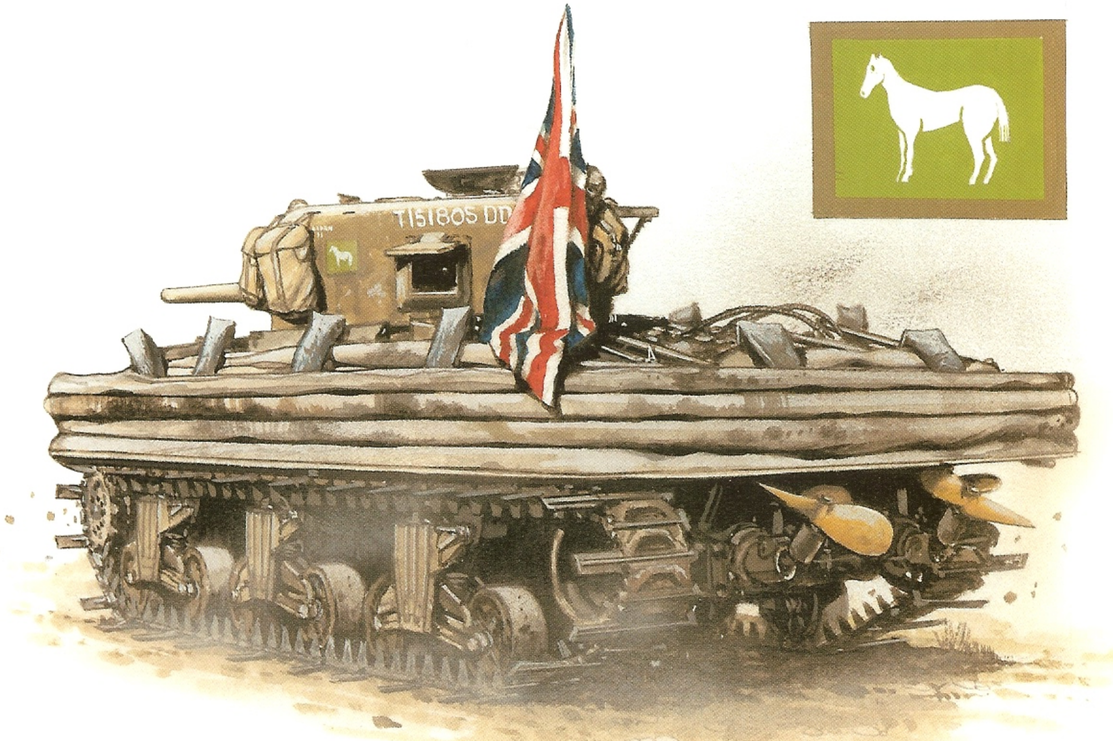
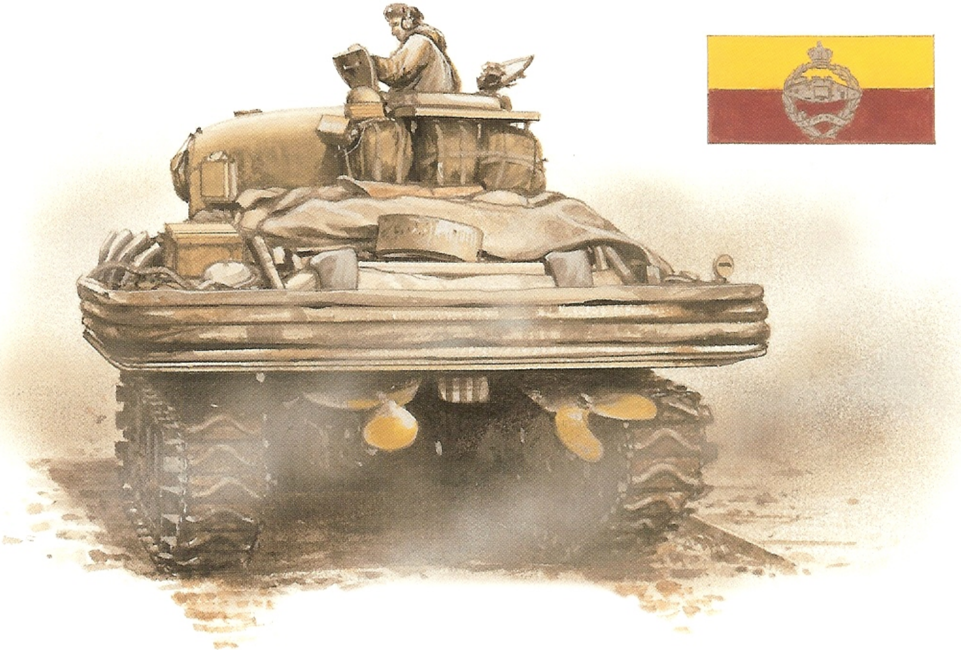
E1: Sherman II DD, 4th/7th Royal Dragoon Guards, Normandy, 1944



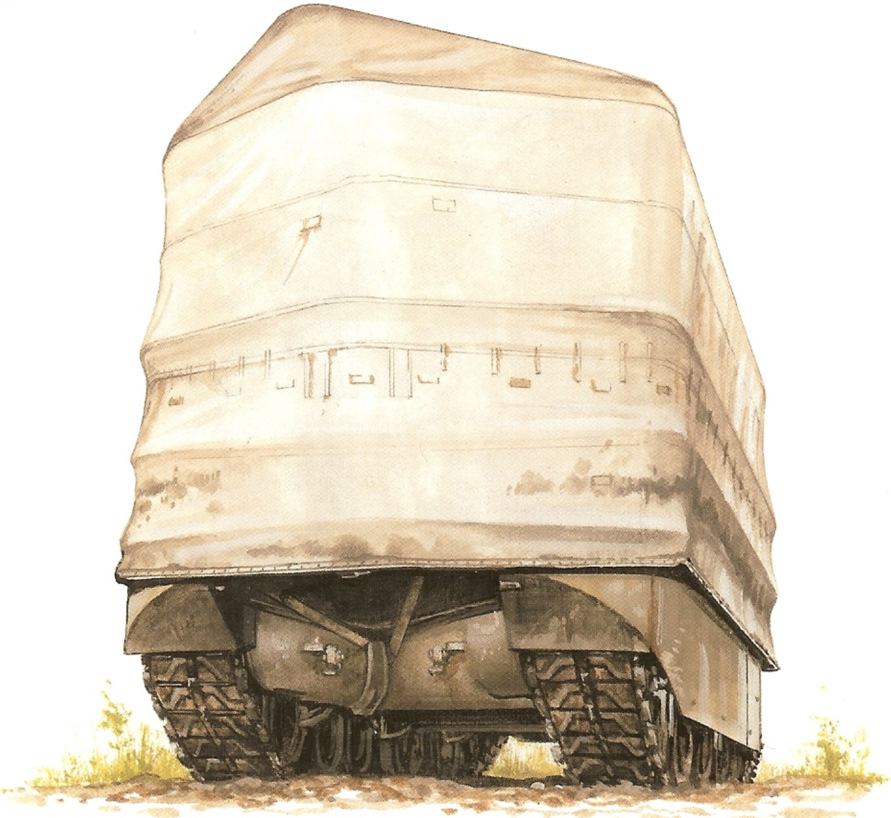
E2: Sherman III DD, B Squadron, 7th Queen's Own Hussars, Venice, May 1945

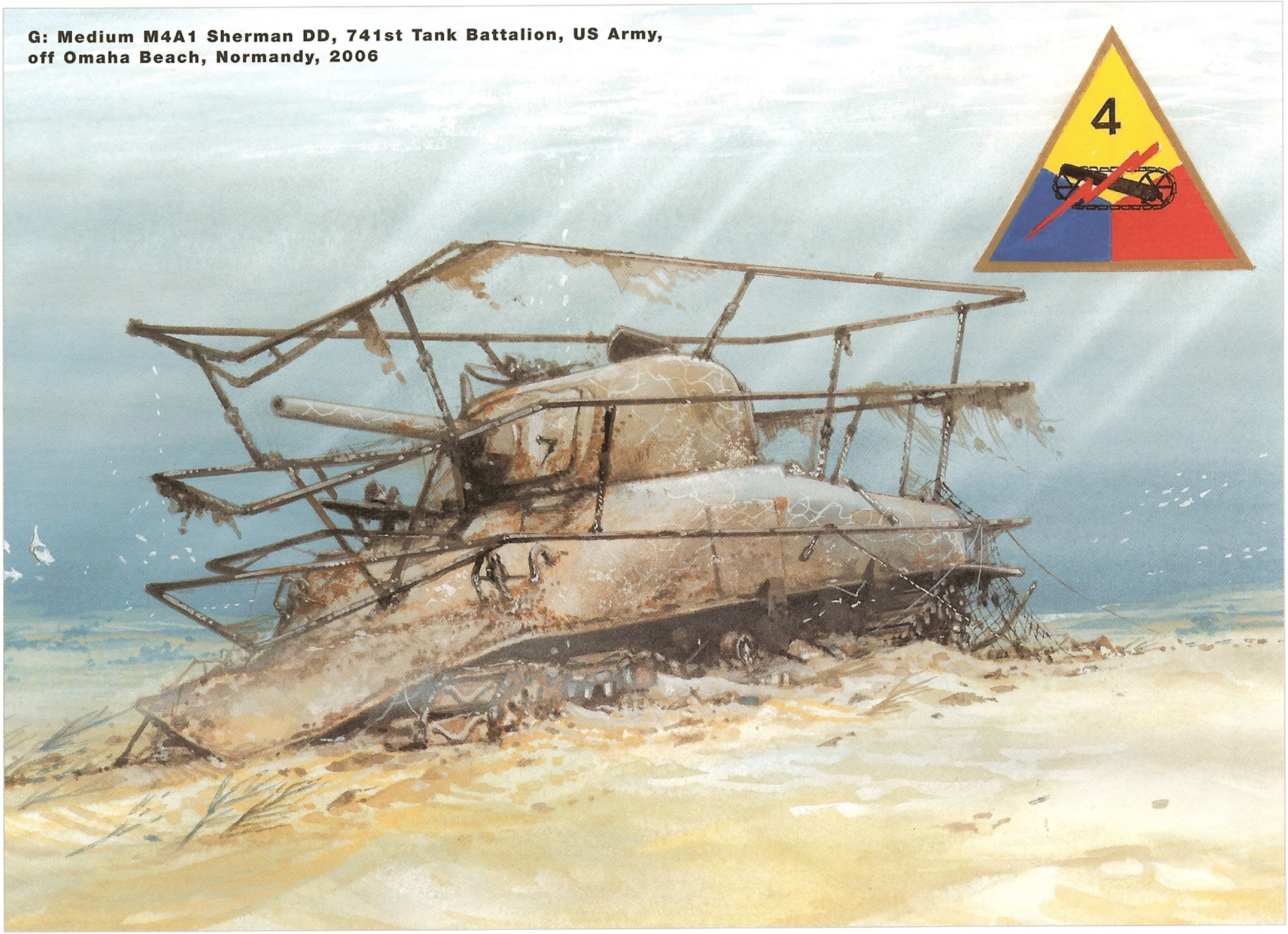


F1: Sherman III DD, 44th Royal Tank Regiment, 4th Armoured Brigade, River Rhine, March 1945



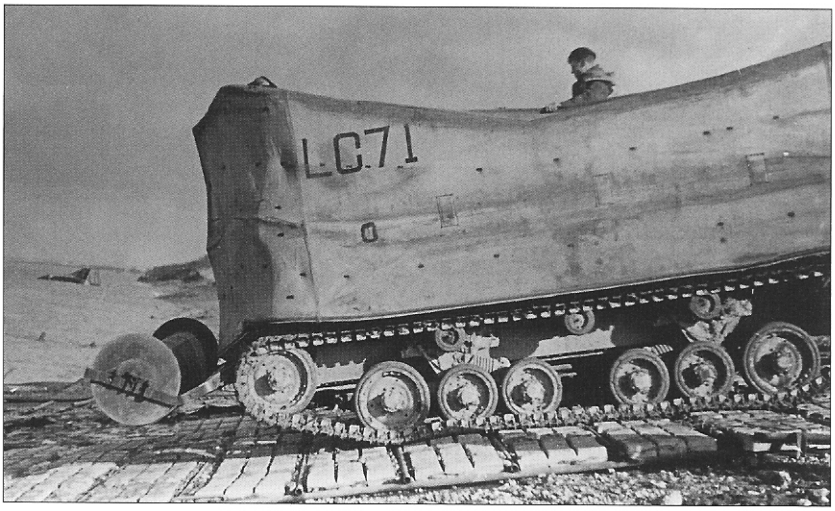
F2: Sherman III AY DD III, Firestone Tire Co., USA, 1945





G: Medium M4A1 Sherman DD, 741st Tank Battalion, US Army, off Omaha Beach, Normandy, 2006

A Valentine DD with a carpet-laying device was tested at Burton-on-Stather as another antidote to soft and slippery riverbanks. It was known by the codename Holy Roller, but does not appear to have been developed.

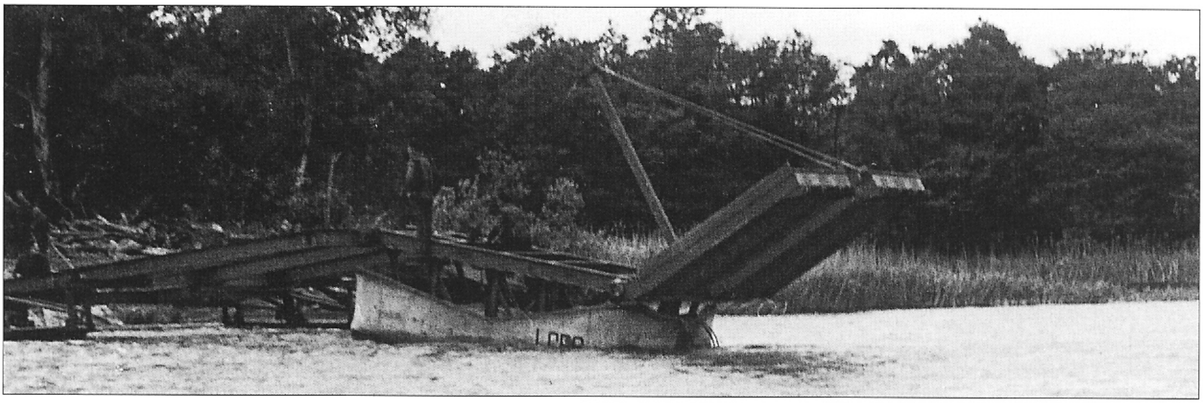


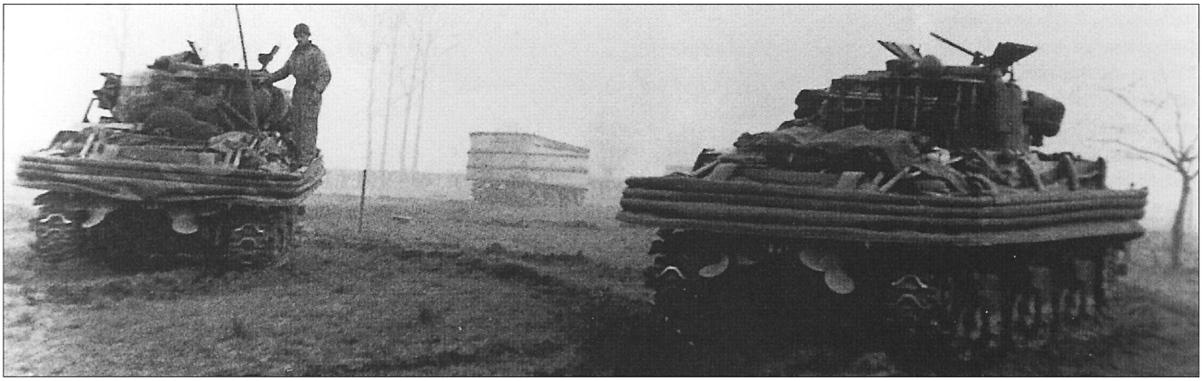
IMPROVEMENTS AND FUNNIES

Perhaps it is not surprising that when DD tanks were discussed in the immediate aftermath of D-Day, it was their sea-keeping qualities that dominated. After the war, when gathering evidence for his claim to a Royal Commission, Straussler solicited the opinion of various senior officers who had commanded in Normandy and they concentrated on the value of the DD as a gun tank. But in the face of losses such as those off Omaha the more immediate concern is understandable. There is some evidence to suggest that before D-Day the vulnerable top rail of the DD screen, where it runs down each side, was stiffened by an additional strip of metal but afterwards more extensive steps were taken.

These included adding extra struts from the sides of the turret to the upper rail and making all the struts self-locking, so it was no longer necessary to kick them. At the same time what is described as a flap was added to the rear of the screen that provided 12in (30cm) more freeboard, presumably to counter the effects of a following sea. Rough sea trials proved that these measures were effective, and they were applied retrospectively to all surviving DD tanks, which were now being referred to as the Mark I type.

This is Hopper, in effect a Valentine DD ARK that carried ramps over which other tanks climbed when leaving the water. In this view, for some reason, it is deployed the wrong way round: the large, fan-shaped ramp on the left should be in the water. Naturally the Hopper tank would not be afloat at this stage.





DD tanks of the Staffordshire Yeomanry, already veterans of the Scheldt battles, prepare for the Rhine Crossing in March 1945. The nearest tank shows well how neatly the screen could fold down if done with care. In the background another DD waits, with its screen partly raised.

The report that carried this information, which covers the second half of 1944, also refers to the Sherman III (M4A2) DD, the diesel version, development of which, it says, 'continued and proved satisfactory'. This long period seems to suggest problems that took a lot of sorting out, but what these may have been is not clear. Meanwhile, work was going forward to develop an improved model that became know as the Mark II DD. This not only had the improvements already recorded but a strengthened top rail of 3in (75mm) diameter, greater depth of freeboard fore and aft by extending the bow and stern canvas, and stronger, self-locking struts. A new design of bilge pump was installed and hydraulic steering was extended to the commander's position on the turret. The old tiller bar seems to have been retained for emergencies, but the commander now had a pillar on his platform, with a handle on the top that duplicated the hydraulic steering system used by the driver. It was hoped to convert 691 DD tanks to this standard by the summer of 1945.

At least one tank had been lost on D-Day when, after launching, the propellers failed to engage and after wallowing for a while it was swamped and sank. The Mark II had improved propeller-locking gear to remedy this and a portable compressor was carried in place of the compressed air cylinders. Trials at sea in a Force 7 gale and a sea state of 5 to 6 proved that these modifications would make the tanks far more seaworthy.

Meanwhile the Sherman itself had been improved. A new turret with a longer 76mm gun on a reshaped hull with a new type of suspension and wider tracks was steadily replacing the old 75mm gun models. A DD variant was clearly desirable and Britain expressed a requirement for 300, based on the M4A2 diesel version that would be designated Sherman III AY DD III where A indicates the 76mm gun and Y the modernized suspension. Firestone Tire Company in the United States (who made the original DD conversion kits in the USA) carried out the design work, but when the war in Europe ended the order was reduced to 200 for use in the Far East. In the event, very few appear to have been made and only two reached Britain.

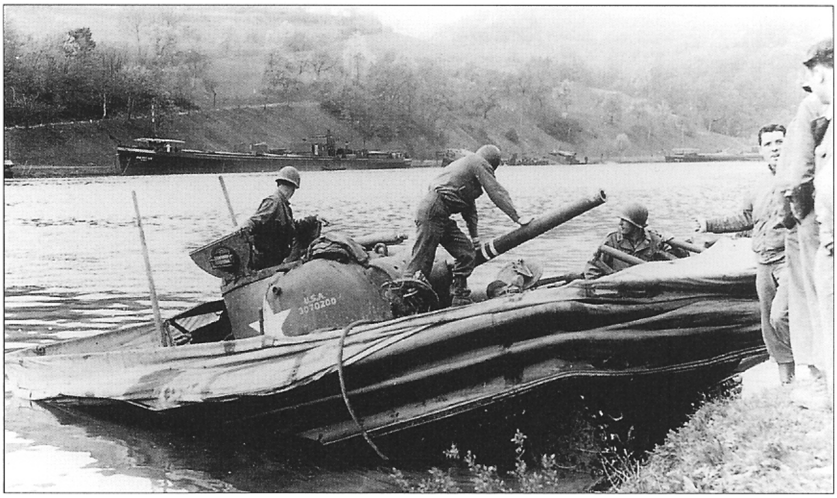
The coastal flame barrage in Studland Bay has already been mentioned. It was feared that if the Germans were using something similar it could have a serious effect on DD tanks, so a device known as Belch was introduced to deal with it. This involved mounting a suction pump on the deck of the tank that drew seawater from below and then squirted it through holes in the topmost tubular frame of the screen so that it soaked the canvas. Trials at Studland soon showed that this worked remarkably well; Belch entered production but was never required on active service.

Landing DD tanks on a gently shelving beach was not a serious problem but 79th Armoured Division, with an eye to the future, put its collective ingenuity towards solving problems of high or muddy riverbanks. For the latter they devised Holy Roller, a Valentine DD with a roll of coir matting sticking out in front that could be laid, like a carpet, over soft ground as the tank emerged from the water. Another Valentine DD, stripped of its turret, was fitted with folding ramps to become an amphibious version of the Churchill ARK device used on dry land. Hopper, as it came to be called, carried a set of folding ramps above the screen so that when it grounded against a high river bank one dropped into the water while the other rested on the bank. DD tanks would follow, scrambling up the submerged ramp, over the other and onto dry land. It was certainly tested at Fritton but whether it ever actually worked is not recorded. Both Hopper and Holy Roller expired at the prototype stage. Another less dramatic solution to the mud problem was Moses, a sort of floating raft, towed by a Landing Vehicle Tracked (LVT) and deployed over the questionable surface. Trials on the River Trent revealed that it was impossible to control in high winds.

There followed the Porpoise, a small, flat raft designed to carry extra supplies of ammunition. Towed behind a conventional Armoured Fighting Vehicle (AFV), as they were on D-Day, they were dragged ashore fully laden, but for DD tanks they floated when half full. Although tested on DD tanks they seem to have hampered performance afloat and were soon dropped.

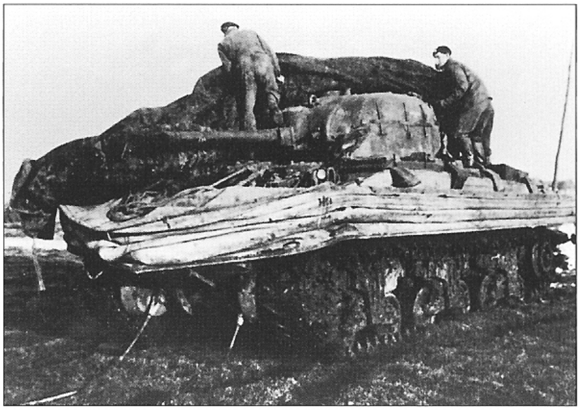
NEW SCHEMES

Despite the unmitigated horror of Omaha the Americans were not yet ready to give up on the DD. With landings in the South of France planned for August 1944, an Amphibious Training Center was established in the Bay of Naples and three Battalions, the 191st, 753d and 756th, were trained there. In the event sea conditions were much calmer and



An American Sherman DD in trouble during training for the Rhine crossing. Owing to shortages both American battalions involved in this operation were brought up to strength with British-built M4A2 and M4A4 types; however this would appear to be a regular American M4A1 type.

resistance much less intense when Operation *Dragoon* was launched and 20 DD tanks swam safely ashore followed by 16 more that landed dry.



In Britain, meanwhile, it was time for another round of military musical chairs. Early in July 1944 the 15th/19th King's Royal Hussars were notified that they were to convert to a Water Assault Regiment and moved down to Fritton to start training. The entire regiment went through the process, that is to say headquarters squadron and the three sabre squadrons, which would require a total of 64 DD tanks and may explain why, as seen earlier, the regiment had 75 DD tanks allotted to it. Training was complete by the end of the month, at which time the regiment was informed that it would not go into battle as a DD regiment after all.

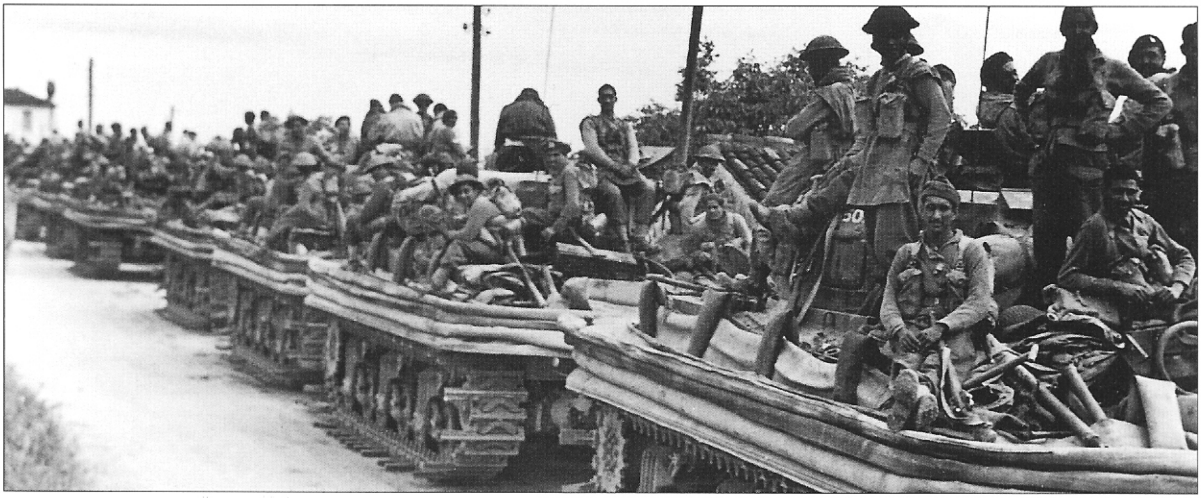
Another Staffordshire Yeomanry picture showing crew members struggling with a heavy canvas cover in ghastly winter conditions. The tank, an M4A4, seems to have been pulled out of some very wet ground to judge from the ropes at the front, although these may simply be ready to throw over the front of the screen once it is raised.

Nobody ever explained to the men what they were supposed to do when the DD training was complete. The most popular theory was a diversionary landing, perhaps in the Calais area, but although they did sea training from the beach at Lee-over-Sands in Essex they never practised launching from landing craft, and that may be indicative. What they did not know was that a change was taking place in France. At that same time, late July 1944, the 27th Armoured Brigade was broken up. Of its three regiments the 13th/18th Hussars, which had used DDs in action, and East Riding Yeomanry, which had trained on them in Britain, were re-allocated while its third armoured regiment, the Staffordshire Yeomanry, which had no DD experience at all, was shipped back to Britain to acquire some. They, presumably, took over the DD tanks now being handed in by the 15th/19th Hussars.

North-West Europe

The Staffordshire Yeomanry, just like the 15th/19th, had all three squadrons and RHQ trained on DD tanks, first at Fritton and then at Burton-on-Stather on the River Trent near Scunthorpe. This location may have given it a clue as to its future since the land is flat and low-lying,

B Squadron, 7th Hussars gives a lift to troops of the 8th Indian Division during the advance on Venice. Whether all those boots and weapons are good for delicate DD equipment is another matter. Notice the heavy-duty track extenders, which were locally made and essential in this low-lying country.

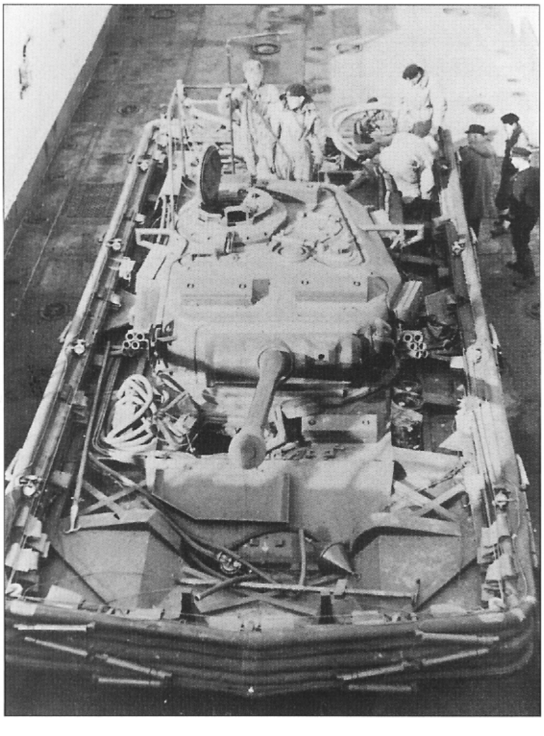


the rivers broad and very muddy. Early in September there was a hurried move to Belgium where, following further training on the Lac d'Hofstade, B Squadron was ordered to Terneuzen. From here, early on the morning of 26 October, 18 DD tanks launched and undertook a 7-mile (11km) voyage across the West Scheldt estuary to land on South Beveland. This journey must qualify as the longest operational cruise ever undertaken by DD tanks, but it is rarely noted by published histories and it came to a sticky end. The original landing place proved too steep for the tanks to climb so they launched again and sought better places along the shore. The result was 14 tanks stuck in thick mud with just four ready for action, and it was three days before the rest were freed.

There were important lessons to be learned, driven home by an attempt in November by C Squadron to swim the Mark Canal near Breda, which proved impossible again due to the steep banks. Ahead lay something even more formidable: the mighty River Rhine. In preparation for what would prove to be a major undertaking, the 79th Armoured Division created a series of training camps in the area, which they called Wings. G Wing, on the River Maas, was responsible for DD tank and Buffalo amphibian training while J Wing, on the Waal, taught navigation. Among other things G Wing undertook the challenging task of training the 44th Royal Tank Regiment (RTR) on DD tanks in just three weeks, in addition to a company from the American 736th Tank Battalion, which was mostly equipped from British stocks.

Two major problems faced the DD regiments on the Rhine: one was a fast-running current, the other steep and muddy banks. For the first a technique was developed that enabled tanks to enter the river upstream from the landing point so that, as they crossed the effect of the current brought them to the far bank in just the right place. For the second the regiments employed reconnaissance parties equipped with LVTs (Buffalos) fitted with special mats that they laid at the exit points as they climbed out, over which the DD tanks would follow. As far as the DD tanks were concerned, Operation *Plunder* commenced late on 23 March when, among others, the Staffordshire Yeomanry made a successful night crossing, losing just two tanks in the process. Since 44th RTR had not had enough time to do the navigation course they crossed in daylight, early the following morning. One or two tanks were lost but again, apart from a struggle to get out of the river, the crossing was considered a success. Another American battalion, the 748th, which was to cross further up river with General Patton's forces at Oppenheim, was obliged to make a long road march up to the river that rendered many of their DD tanks unfit for the operation.

The swan song of the DD in North-West Europe fell to an enlarged squadron of the Staffordshire Yeomanry that swam the Elbe at Artlenburg on 29 April 1945 and, rather fittingly, they were temporarily attached to 33rd Armoured Brigade of 79th Armoured Division. The village in which they assembled and inflated their tanks, preparatory to launching, was entirely cleared of



An overhead view, taken from the bow of an LCT(8), showing the experimental Centurion DD with its screen folded down during trials at Instow in North Devon. Note how the folding screen support struts have been moved to the outside.

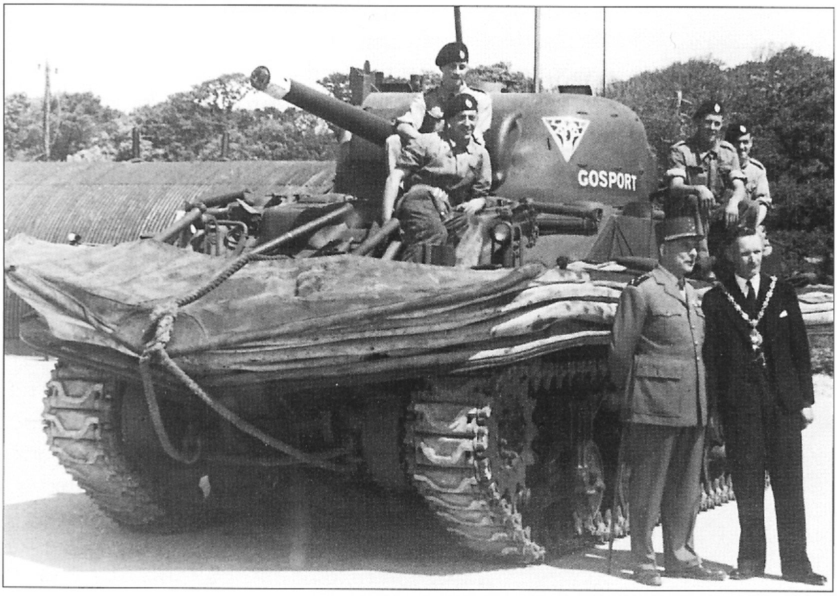
its residents. This could hardly have been in the interests of secrecy – presumably there was some fear of sabotage to the vulnerable screens.

There remains one intriguing DD operation that might have been. Very late in the war plans were drawn up to liberate Amsterdam by sailing an amphibious force across the Zuider Zee. For no obvious reason the Westminster Dragoons, who since D-Day had been operating Sherman Crab mine-clearing flail tanks in 30th Armoured Brigade, were ordered to commence DD training and, while waiting for the tanks to arrive, were given some Valentine Archer self-propelled guns to train on. This led them to believe that they would be issued with Valentine DD tanks, rather than Shermans but, of course, the attack was never launched.

Italy and beyond

There was always a sense that things were done slightly differently in the Italian campaign, and this was equally true where DD tanks were concerned. In 1944 the 3rd Hussars began training with DD tanks but then handed them over to the 7th Hussars who, after an initial training period, were ordered to cease. Late in February 1945 the 7th Hussars once again took over DD tanks, both Valentines and Shermans, and started re-training. All three squadrons were involved.

On 24 April 1945 the regiment, split into squadrons that each supported a different division, was sent to cross the River Po on a broad front. From now on each squadron was on its own, and it would take too long to recount all their activities. Suffice it to say that, following a successful crossing of the Po those DD tanks still fit enough to swim took part in an assault crossing of the River Adige on the 28th where two Valentine DDs of A Squadron were used to bring up 400 gallons (1,818 litres) of diesel fuel for the Shermans, which must have been M4A2s. This is the only recorded use of Valentine DD tanks on active service. On the final advance to Venice, which did not require more swimming, the 7th Hussars' DDs carried infantry and discovered that with the screens folded down it was possible to get an entire infantry platoon onto each tank.



Sherman III DD II Gosport sporting 79th Armoured Division insignia, now inherited by the Specialized Armour Development Establishment, which had an amphibious wing based at Gosport in Hampshire. The mayor of Gosport stands alongside the tank with General Jean de Lattre de Tassigny on an official visit from France. Notice how the towrope is rigged for emergency use at sea.

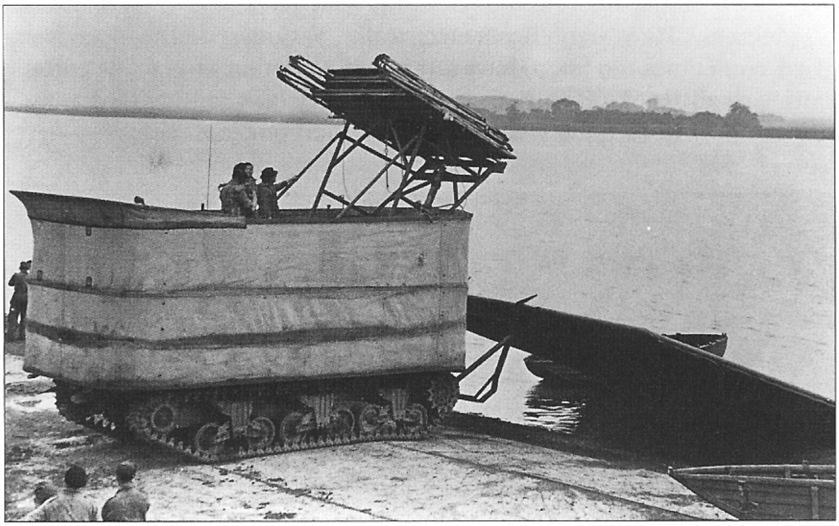
Finally in the war period, it remains to record that the 25th Dragoons, then fighting in Burma, were recalled to India in July 1944 to convert to the DD role for operations in Malaya that, in the event, came to naught when the war ended. The regiment was based at Cocanada in Andhra Pradesh where it did extended sea trials, but after all this effort it rushed back to Burma in April 1945 in conventional tanks. At the end of the war an experimental squadron was formed, operating a variety of specialized tanks, including DD tanks, and for a while the squadron appears to have been under the control of the 3rd Dragoon Guards (Carabiniers). A surviving DD at the Indian Cavalry Museum at Ahmednagar suggests that most of these tanks were handed over to the Indian Army when the British finally pulled out.

POST-WAR DEVELOPMENTS

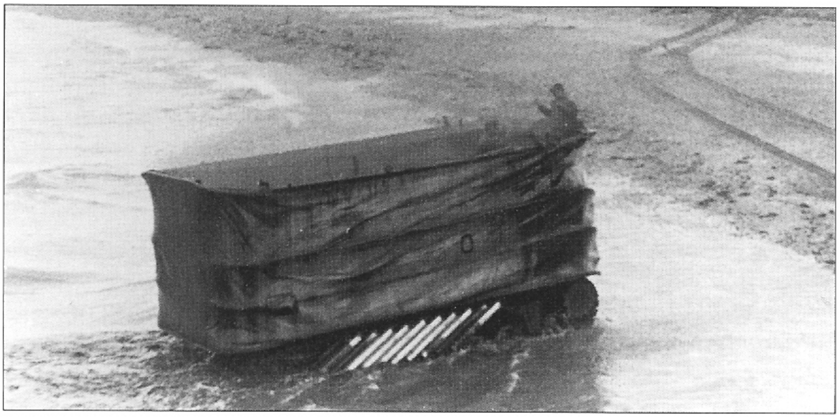
Writing at the end of the Second World War Field Marshal Montgomery noted, 'The smaller our Army in peace-time the greater the need for a strong and robust organization devoted to research and experiment; in the British Army the nucleus of this organization may well be the 79th Armoured Division.' And so it was – for a while.

The Specialized Armour Development Establishment (SADE) was formed by amalgamating what remained of 79th Armoured Division with the Assault Training and Development Centre plus the Canal Defence Light School. What concerns us here is C Wing, the AFV Flotation Centre based at Gosport in Hampshire, although it continued to carry out experiments at other sites, particularly where these were already functioning.

Interest in specialized armour expanded rapidly after D-Day, and the number of experiments snowballed to such an extent that even those relating to DD tanks will get no more than a few words here. Two were concerned with assisting a DD tank out of a river where it must first cross an area of soft mud, following the wartime trials of Hopper and Holy Roller.



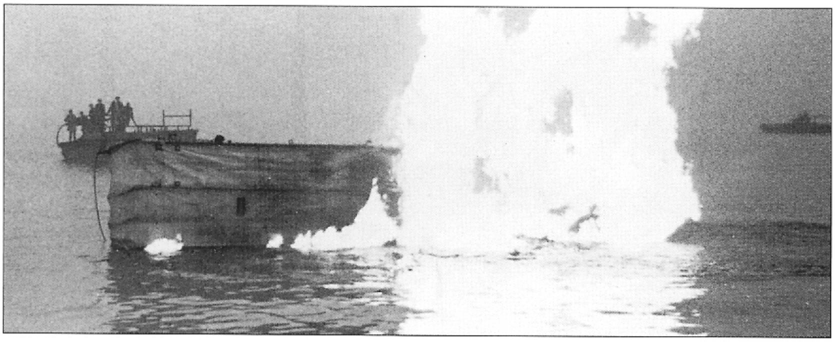
Nicholas Straussler himself was behind the design of Gin-and-It, which consisted of a large mat, already deployed on the right, and a set of panels folded concertina fashion that stretched out beyond the mat as a tank climbed up the bank.



Another method of overcoming a difficult landing was by rockets. A bank of ATOG aircraft rockets are attached to the suspension of this Sherman DD to be fired as it comes ashore. Success tended to depend on how evenly the rockets burned and how much soft ground had to be covered.

Gin-and-It was one of Nicholas Straussler's inevitably complicated efforts. An Sherman III (M4A2) DD was fitted with a three-piece shield in front of the screen and a folded mat on the end of a flimsy jib structure that stuck up above the screen. In theory, as the tank came ashore a spade at the front dug into the mud and triggered the shield, which fell forward and opened out to provide a firm surface for the tank to stand upon. At the same time the jib, activated by compressed air, would start to unfold the five-section mat ahead of the tank and, when it was laid, gave the tank a 40ft (12.2m) path onto dry land. In practice it never seems to have worked properly.

Rockets were another source of amusement for the staff at SADE. At one time it seemed there was nothing they could not do. In terms of DD operations rockets were seen as an alternate method of extricating tanks from mud or assisting them over riverbanks that they could not climb unaided. Once again the trials tank was a Sherman III (M4A2) DD and the trials locations were Tidworth on Salisbury Plain, Stokes Bay on the Solent and Hawley Lake in Kent. The rocket employed was the 5in (127mm) ATOG No.5 Mark I, which had been designed originally to provide assisted take-off for aircraft. It developed 1,410lb (640kg) of thrust for 3.5 seconds and the trick was getting the number of rockets right for a 35-ton (35.5-tonne) tank. The rockets were mounted on each side of the tank, on brackets at suspension level and angled back at 30 degrees. They were fired electrically. Various combinations were tried, sometimes too few to have any effect, sometimes too many and the tank virtually took off, but always with spectacular results. Generally it appeared to work quite well and drivers soon got used to it, but there



Trials of the rocket egress system carried out at Gosport sometimes achieved interesting, if unpopular, results if the tank's screen was set on fire. Here observers on an LVT(4) Buffalo watch as the flames take hold. The tank is certainly not afloat and further shots in the series show the rear end of the screen burned down to the waterline.

were occasions when the screen buckled under the pressure or even caught fire, which was not at all what was required.

The fact that a DD tank could not shoot while it was swimming exercised some minds. Wise men might feel that swimming was quite enough, but others are never satisfied and at least three experiments were conducted. In one a pair of .30-calibre Browning machine guns were mounted on the screen and fired by cable. In theory they were linked so that both would fire in the same direction, at the same elevation, but this was never achieved during trials and the project was dropped.

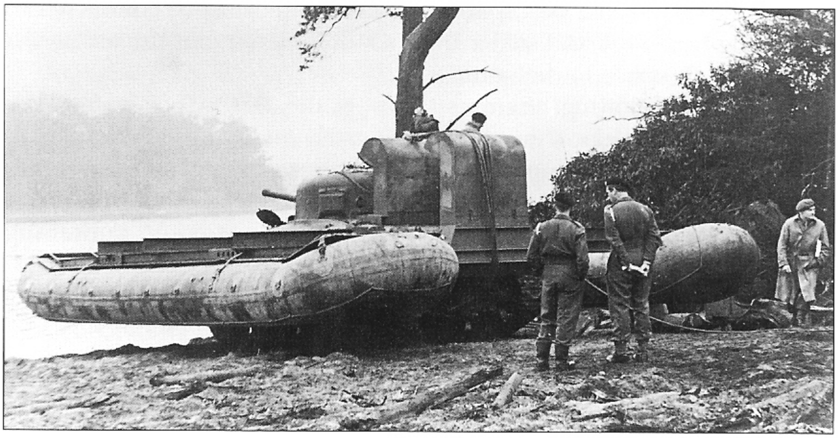
Working on the principle that a recoilless gun might be fired from the top of the screen without bending it, trials were conducted with a 3.7in (94mm) weapon – fortunately never actually on a DD tank. These weapons rely, of course, upon blast to counter the effect of recoil and the trials team found that there was no way of firing the gun or deflecting the blast that did not involve totally wrecking the screen, so they gave up.

Altogether more promising was a scheme to fire a 3in (75mm) mortar attached to the turret of a Sherman DD, in order to bring down fire on the hostile beach. With the mortar loader working from the commander's hatch and the helmsman aiming the tank this seemed to work reasonably well, but only in a flat calm with no effect from wind or tide. Accuracy fell off rapidly as conditions deteriorated, so this scheme was also abandoned.

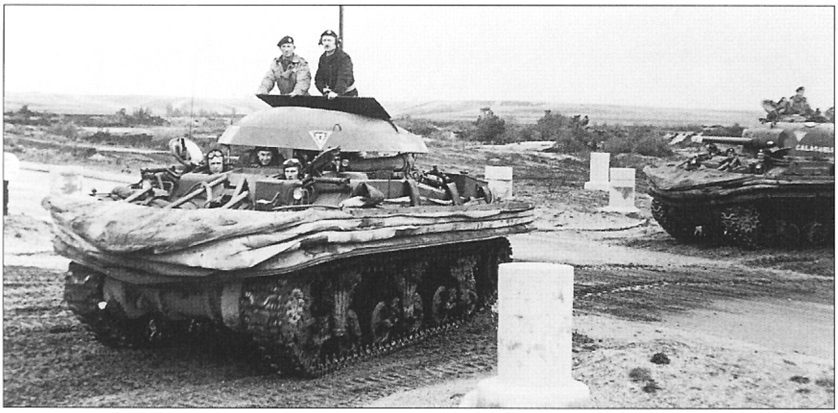
SADE was also involved in trialling different types of inflatable dinghy for DD tanks. Their favourite was the five-man D Type Mark 2 as used aboard Air-Sea Rescue launches. Unlike the round type normally issued, this model had a distinct bow shape at the front and could be paddled in a given direction rather than round and round.

Mention should be made of other SADE trials that were DD related, including one to fit twin rudders for steering, which certainly showed an improvement, and experiments with various types of extended periscopes that were intended to give the driver of a DD tank something to look at rather than just the interior of the screen. They even went so far as to evaluate a new type of grease gun that, it was hoped, would make the task of packing the bearings of a DD tank easier, which it did.

Knowing, as we now do, that the whole concept of the DD tank, at least as it was at the time, was already doomed it is interesting to see to what lengths SADE was prepared to go in order to expand it. For



British trials of the American M12 flotation device that employed two inflatable engineer pontoons, powered by twin outboard motors. Despite having to fit deep wading gear as well, the Americans preferred this system since the tank could shoot while afloat. However, it was much too wide to operate from landing craft.



The unique Sherman Kangaroo DD, here in the M4A4 form, showing the protective cover over the turret ring from which infantry peer out. A regular DD gun tank named Galashiels follows the Kangaroo.

example, in October 1946 it began tests of what they called an APCDD, or Armoured Personnel Carrier Duplex Drive, using a turretless Sherman tank just like the wartime Kangaroo. A prototype was created on a Sherman III (M4A2) but then had to be switched quickly to an Sherman V (M4A4) when the former were withdrawn. It was simple enough: the tank's turret was lifted off and the space used to carry infantry, presumably a section, say ten men. A mushroom-shaped overhead cover provided protection, but the report does not reveal whether or not it was easy for the men to scramble out once ashore. Indeed the trial seems to have been simply to see if the Sherman V could be converted to this role, not whether it worked.

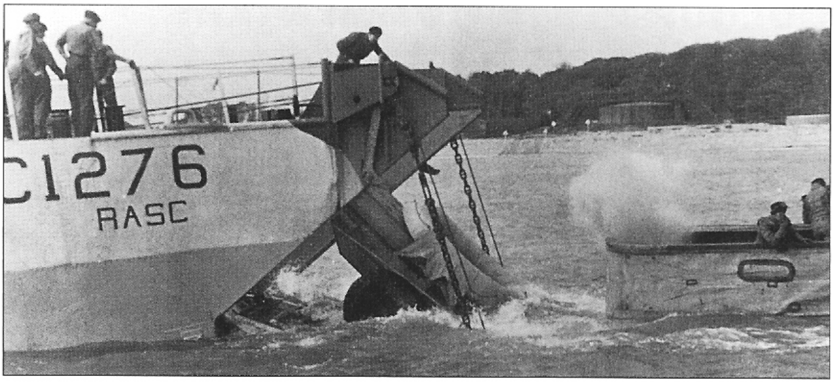
It may seem to be tempting providence to launch a DD tank with a trailer, especially after the experience with the Porpoise. Yet it was done, apparently as part of an attempt to create a DD version of the Sherman Crocodile flame-thrower. The Sherman Crocodile had been developed for the Americans and used on a limited scale during the war. These post-war trials probably involved an ordinary Sherman DD to which the standard Crocodile trailer was attached. Three methods of providing buoyancy were tested: by attaching an inflatable boat or a steel flotation chamber to the trailer or by simply towing it and relying on the wash from the tank and the trailer's tyres to keep it afloat. All three worked after a fashion, although it proved too difficult to secure the rubber dinghy to the trailer firmly enough, and with no buoyancy aids at all the trailer floated very low in the water and affected the tank's steering. The steel box worked best, particularly when trials were conducted in launching both tank and trailer from a landing craft, but the trailer was never entirely stable in the water.

As it was, following attempts to apply the DD principle to more modern types of tanks, it was dropped entirely (at least using Straussler's system). For a generation the British Army restricted its amphibious role to lighter AFVs, in fact to virtually anything except tanks, using a concertina screen that just about worked in calm conditions but relying on the vehicle's tracks or wheels to move it through the water.

CONCLUSION

While making a case for an award for his invention after the war, Nicholas Straussler solicited opinions from a number of senior officers,

Trial launch of a Sherman DD towing a Crocodile flame-thrower trailer, which floats with the aid of an RAF rescue dinghy strapped on top, from an LCT(4) of the Royal Army Service Corps off Stokes Bay.



and their replies were preserved. Writing of D-Day they all agreed that without the DD tanks things might have been a lot tougher, at least on the British beaches, but D-Day was a one-off event and always will be. One could debate the value of subsequent DD operations.

Yet, as we have seen, DD development continued for some years after the war and was succeeded by other amphibious creations that did more or less the same thing. Thus it is probably safe to say that Straussler's DD system had its day on 6 June 1944 and was a wasting asset thereafter. Never mind, it was a brilliant innovation employed with remarkable courage that still generates an amazing amount of interest. That is more than enough to justify this short study.

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COLOUR PLATE COMMENTARY

A1: VALENTINE V DD, A INSTRUCTIONAL WING, 79TH ARMOURED DIVISION, FRITTON DECOY, 1942

This was one of the main production versions of the Valentine, powered by a General Motors diesel engine and armed with a 2-pounder gun and co-axial Besa machine gun. It was fitted with an enlarged turret to take three men and, as shown, this was traversed aft when the flotation screen was raised.

The colour of the screen is described in official documents as 'Mountbatten Pink', whatever that was, but to the average viewer had the creamy look of canvas with a greyish tint probably caused by the impregnated rubber that kept it waterproof. It all became somewhat darker when wet.

Although they had been trained in the use of special underwater escape apparatus, most crews during training relied on conventional lifejackets and a standard lifebelt, carried on top of the turret for emergencies.

The insignia of the 79th Armoured Division reflects the fact that the first three regiments to be trained for DD work, on tanks such as this, all came from that division's 27th Armoured Brigade.

A2: VALENTINE XI DD, 3RD KING'S OWN HUSSARS, ITALY, 1944

This was the last mark of Valentine tank to be built and the only Valentine DD to see active service. Powered by a more powerful version of the GMC diesel it was armed with a 75mm dual-purpose gun and a Besa machine gun in a cramped turret that could just about accommodate two men.

This drawing has been contrived to show how the tank sat in relation to the flotation screen. These later-production Valentines were somewhat longer than the early versions, but even so the longer gun still required the turret to be traversed aft before the screen could be raised. The air pillars that raised the screen and the tubular bars that held it in place are shown on the far side and the single propeller is in the lowered position ready for swimming.

Some of these tanks were sent out to Italy where they were issued to the 3rd Hussars (whose badge is shown) and 7th Hussars. This last regiment used some of them on active service, albeit in a support role, but there is no recorded evidence of their seeing combat action.

B1: SHERMAN V DD, 2ND CANADIAN ARMOURED BRIGADE, NORMANDY, 6 JUNE 1944

The tank is preparing to launch from the deck of an LCT(3). The screen is fully raised and the propellers deployed in readiness for the swim ashore to Juno Beach.

Tarry sealant compounds such as Bostick were used to cover all those parts of the screen where metal and canvas met, and most particularly where bolts passed through the fabric. However, photographic evidence from D-Day suggests that some Canadian crews went mad with the stuff and plastered it everywhere to improve their chances of staying afloat.

At least one of the Canadian regiments, the 1st Hussars or Fort Garry Horse (or maybe both), seems to have used two- or three-digit numbers in varied colours painted high up on the back of the screen for identification purposes, although no explanation of the system can be found.

The insignia is that of the 2nd Canadian Armoured Brigade.

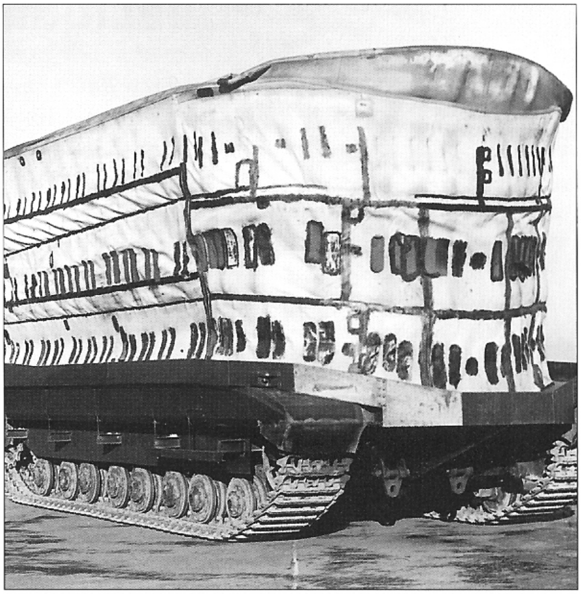
B2: SHERMAN II DD, C SQUADRON NOTTINGHAMSHIRE (SHERWOOD RANGERS) YEOMANRY, NORMANDY, 6 JUNE 1944

The launching process was probably the trickiest operation for DD crews. They had to avoid catching the screen on any part of the ship and ensure that as soon as they were afloat the tank moved clear of the submerged ramp. Here the commander/helmsman watches anxiously as Lily of the Sherwood Rangers takes the plunge for the run-in to Gold Beach.

Lily was later photographed in Bayeaux with her screen down. The tank was a Sherman II (M4A1) DD supplied directly from the USA as a DD tank. In addition to the name it carried the turret number and C Squadron circle as shown.

C1: SHERMAN DD TANK SWIMMING, VIEWED FROM ABOVE

The crew have been omitted from this unusual view in order to show as much detail of the tank as possible. In fact, during the run-in to the beach all but the driver would probably be 'on deck'. The commander, as helmsman on the platform at the rear of the turret, and the other three crew members are



The ultimate DD tank. Hidden behind this enormous screen is one of the prototype FV200 series heavy tanks, a forerunner of the 65-ton (66-tonne) Conqueror. As FV200, or the Universal Tank, it was in theory capable of conversion to any role from flame-thrower to bridge-layer, but this DD variant was abandoned because it was too big to operate from any available landing craft.

doing their best to prevent the sides of the screen from being forced inwards due to the pressures of wind and tide.

Most accounts imply that once the skill of handling the tank afloat had been mastered it was not difficult to manoeuvre, although with a top speed in the water of no more than 6mph (10km/h) it was very much at the mercy of the effects of wind and tide.

As mentioned elsewhere, for seaborne operations each tank was issued with a small dinghy of the Royal Air Force pattern, which self-inflated for use in an emergency. Unfortunately it has not been possible to establish just where on the tank it was stowed, so it has not been included.

C2: SHERMAN V DD, A SQUADRON, 13TH/18TH ROYAL HUSSARS, NORMANDY, 6 JUNE 1944

One peculiarity is the screen, seen in many photographs draped over the rear of some DD tanks of the 13th/18th Hussars. Each screen was divided into a chequerboard pattern of blue/green and white squares. They were visible when the tanks were swimming and can also be seen hanging down the back of tanks operating ashore. Whether they were unique to this regiment, or even to one squadron of the regiment, cannot be established but an example is shown here as a tank, in the shallows, drops the front of its screen and engages enemy targets on Sword Beach.

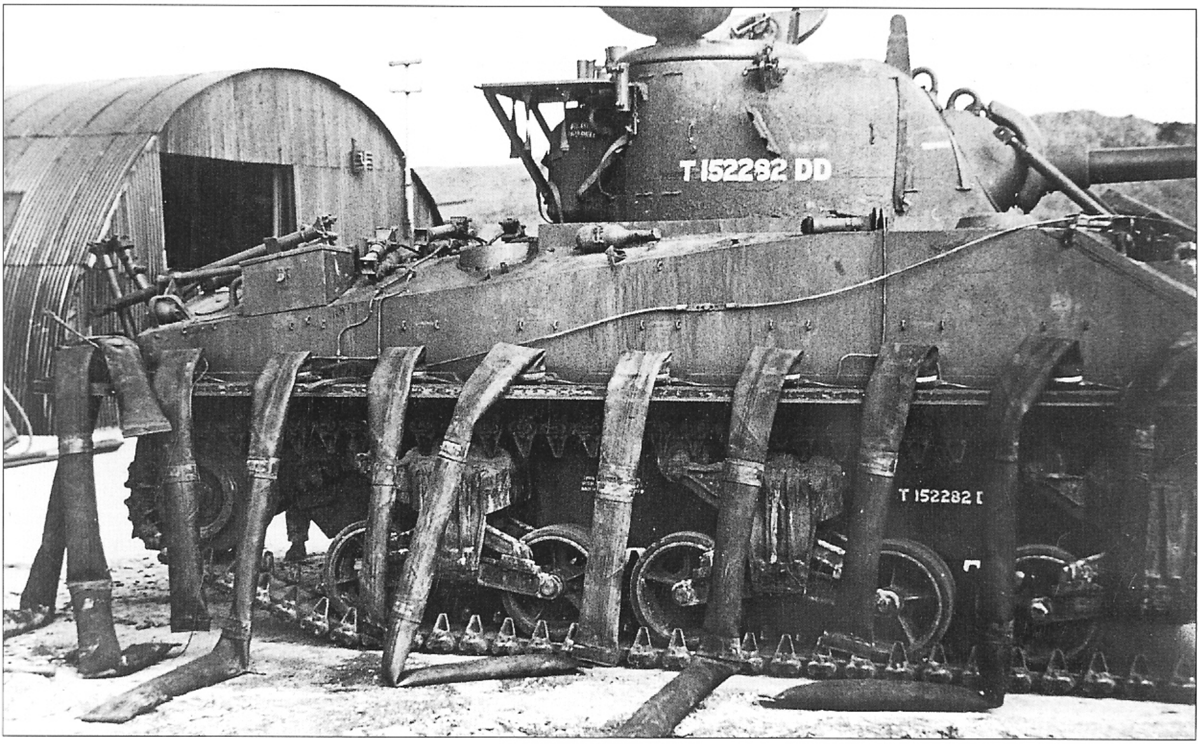
The 13th/18th had another practice that appears to be unique. Bearing in mind that the brigade sign and arm of service marking would normally be invisible below the surface they are seen, on some tanks, painted on the gun mantlet. The seahorse is, of course, the insignia of 27th Armoured Brigade while 51, in white on a red square, indicates the senior regiment in that brigade – 13th/18th Royal Hussars. The larger turret number 43, in red outlined in white, indicates an A Squadron tank.

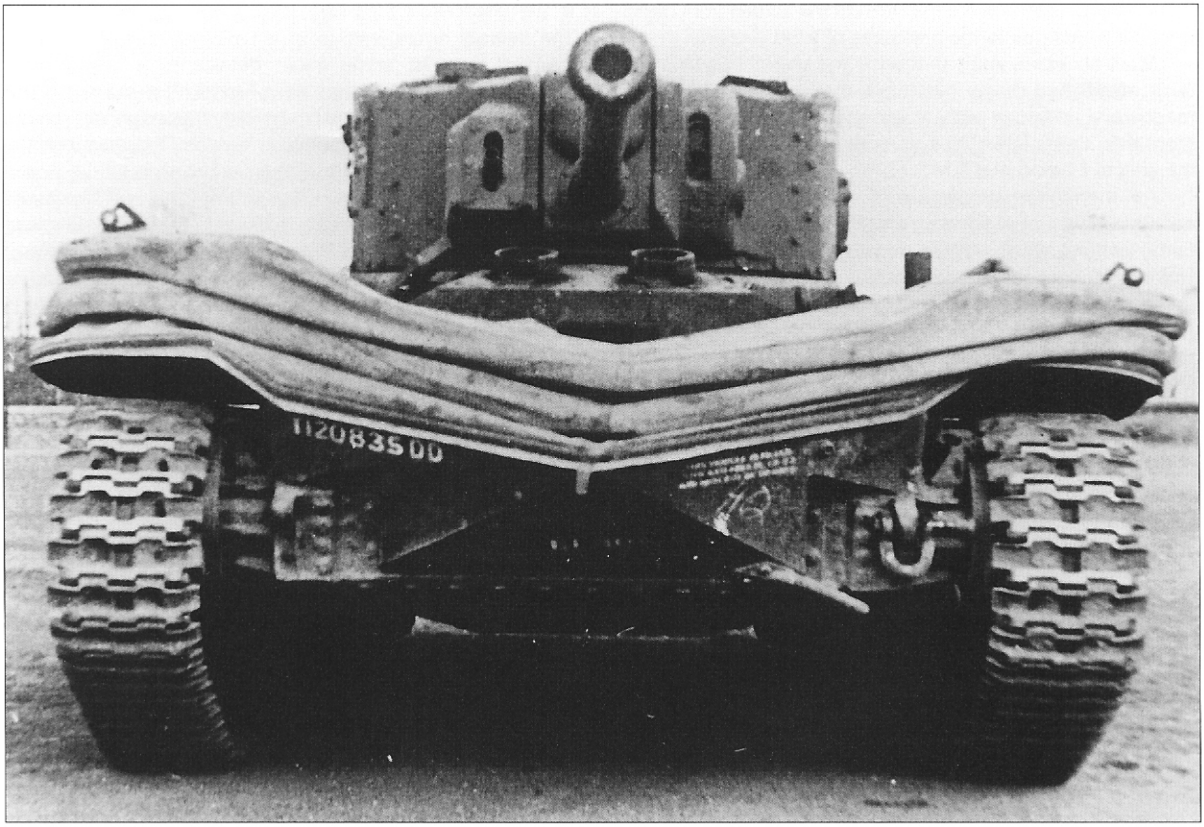
D: SHERMAN III (M4A2) DD

The internal arrangements of a typical Sherman DD were identical, but for some minor details, to a conventional Sherman tank, a type that has been illustrated many times before. Here we intend to show mainly those special features that characterize the amphibious version. To begin with the screen itself, formed from rubberized canvas fabric: notice that the lowest level is three layers thick, the next two layers thick and the top just a single thickness. The screen is raised and supported in the first instance by large-diameter tubes of black rubber that are attached to special valves arranged all around the base and linked by a system of pipes, taking compressed air from two cylinders situated at the front of the tank. As the screen rises it takes up with it horizontal tubular frames that maintain the shape of the screen and are supported, when in position, by jointed struts attached to various parts of the hull. These are locked in place manually, but can be broken by hydraulic action when the screen comes down.

On Sherman tanks the tracks are driven via sprockets mounted at the front, but on the DD version similar sprockets are attached to the idler wheels and are, in turn, driven by the motion of the tracks. Drive then proceeds by short shafts into bevel gearboxes situated low down at the back of the tank and

End of the line: an Sherman III (M4A2) DD in the process of being stripped of its flotation equipment. Severed air pillars hang limply at the sides and some of the folding screen support struts remain, but this shot affords a very good view of the commander's platform on the back of the turret. Notice too the practice of repeating the War Department number on the lower hull side.





A frontal view of a Valentine XI DD with the screen folded down and turret swung round to face forwards. The arrangement of the decking, beneath the screen, is well shown in this view, as is the location of the WD number, painted where it can be seen even when the screen is raised.

from here drive passes through 90 degrees to another shaft ending in a simple ratchet clutch. When the propellers are lowered their shafts engage these clutches and drive continues though to the propellers. The propellers are also linked by a system of rods and a cross bar to a tiller arrangement located on the rear hull of the tank, and this tiller is within reach of a man standing on the special platform attached to the rear of the turret. From here the commander can see over the rim of the screen and steer the tank in the water. He has a binnacle compass on a post alongside him while the driver, who is also able to steer via a hydraulic linkage, can see through an extended periscope fitted to his hatch.

E1: SHERMAN II DD, 4TH/7TH ROYAL DRAGOON GUARDS, NORMANDY, 1944

B and C Squadrons came ashore at La Riviere on Gold Beach after little more than a wade with their screens raised. As soon as possible the screens and other DD fittings were taken off the tanks. Only the waterproof deck section, which proved useful as a stowage tray, remained. In this form many of the tanks, which appear to have been of the cast hulled M4A1 type, were seen in action many miles inland long after D-Day.

Limited photographic evidence suggests that this regiment also used a system of turret numbers, at least on their DD tanks, to indicate troops and squadrons, although the sequence is not known. Number 55 was photographed trapped in soft sand on the beach and a still from a colour film of the time suggests that the white outline figures were painted direct onto the turret with no infilling colour.

Both the 4th/7th Dragoon Guards and East Riding Yeomanry formed part of 8th Armoured Brigade, whose insignia was the fox's mask as shown.

E2: SHERMAN III DD, B SQUADRON, 7TH QUEEN'S OWN HUSSARS, VENICE, MAY 1945

DD tank operations in Italy were limited to crossing inland waterways, mostly in the north-east of the country towards the end of the campaign. The 7th Hussars, who were equipped with a mixture of Sherman and Valentine DDs, were photographed during the advance on Venice, carrying men of the 8th Indian Infantry Division.

This Sherman III DD displays the White Horse insignia of the 9th Armoured Brigade painted on the turret alongside the WD number. These operations were conducted over low-lying soft ground that could easily disable tanks, so they were fitted with locally manufactured track extenders to spread the weight and improve traction.

The tank shown here was sporting a large and bright Union flag when it was photographed on the Piazzale Roma in Venice when the war in Europe ended in May 1945.

F1: SHERMAN III DD, 44TH ROYAL TANK REGIMENT, 4TH ARMOURED BRIGADE, RIVER RHINE, MARCH 1945

Unlike D-Day, all three squadrons and regimental headquarters were equipped with DD tanks for the Rhine Crossing, so their Fireflies must have been temporarily withdrawn. Once again, in this boggy country the tanks were fitted with track extenders, but of the shorter American pattern unlike those provided in Italy. Our tank is shown ashore, with its screen folded down and the marine propellers tucked up under the back of the hull.

Most of the higher-numbered Royal Tank regiments had been converted from the infantry and the 44th RTR had once been the 6th Battalion the Gloucestershire Regiment. Members of the regiment wore the black beret and RTR badge, but in typical RTR fashion each regiment had its own distinguishing colours, quite distinct from the collective RTR colours of brown, red and green. In this case the 44th RTR had the colours shown, usually worn on uniforms as a shoulder flash.

F2: SHERMAN III AY DD III, FIRESTONE TIRE CO., USA, 1945

The need to adapt the DD principle to more modern Sherman tanks with larger guns had been appreciated from the start, but it was a luxury that had to wait. Towards the end of the war a 76mm version of the M4A2, with the enlarged T23 turret, new-style hull and revised suspension, was adapted to the DD role in the United States. Our drawing shows one of these tanks on trial with its screen raised. Various modifications had been introduced including a streamlined fairing between the tracks at the front and panels covering much of the suspension, which no doubt reduced resistance in the water.

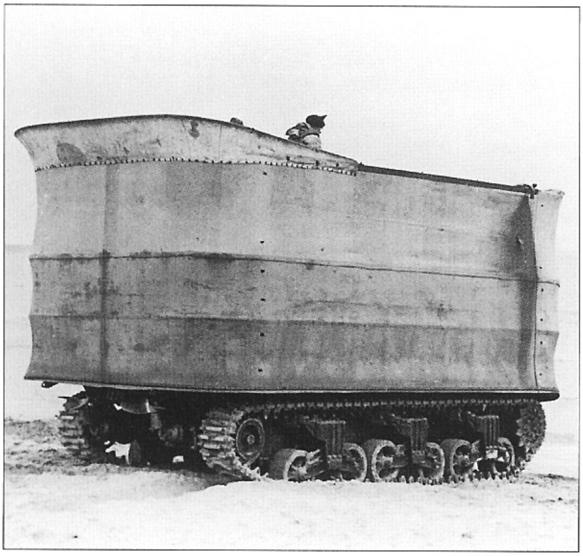
The smart, taut look of the screen suggests that the manufacturers had come up with an improved fabric and, although not visible here, it is clear that the designers had abandoned hydraulic steering, at least for the helmsman, in favour of the old-fashioned tiller bar. Yet at the same time the helmsman's platform was no longer fitted to the back of the turret.

Intended for British service as the Sherman III AY DD III, these tanks were never issued, although a survivor remains in the Ordnance Museum Collection at Aberdeen Proving Ground, Maryland.

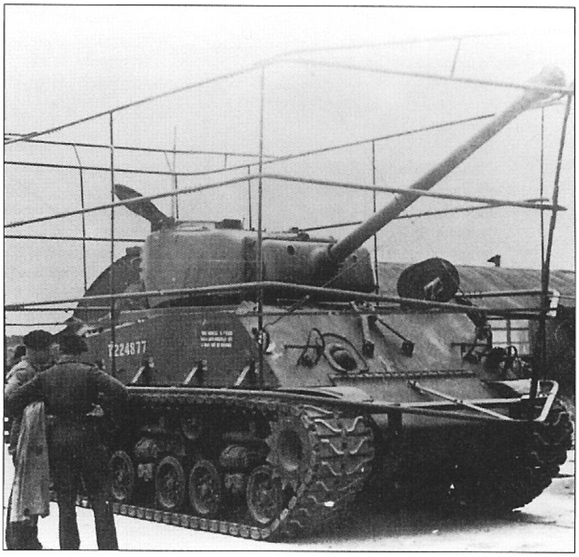
G: MEDIUM M4A1 SHERMAN DD, 741ST TANK BATTALION, US ARMY, OFF OMAHA BEACH, NORMANDY, 2006

D-Day was a long time ago. Tourists now flock to the area to visit the museums, gaze at the battered defences or take a more serious stroll around the neat but crowded cemeteries. Yet other relics remain, hidden from view. The seabed is littered with the debris of war, from sunken ships to weapons of every shape and size. Few can be more poignant than the sunken DD tanks of the 741st Battalion, US Army, lost as they struggled to reach their objective on Omaha Beach in the face of strong winds and tides in a choppy sea.

Most are still there, the canvas screens rotted away, what remains of the rubber pillars loose and flapping with the currents. Each one is liberally encrusted with marine life and often draped with snagged fishermen's nets, but they are only visited by indifferent sea creatures. Fortunately many of their crews survived, but for those who were lost there is something immeasurably sad that young men, prepared to give their lives in the Allied cause, should instead die without coming to grips with the foe.



An Sherman III (M4A2) DD on the beach at Studland Bay. Notice that the propellers are still folded up and that the idler does not have an extra sprocket ring to facilitate drive. By this time it had been discovered that friction between the tracks and conventional idler was quite sufficient.



In the United States production of 76mm gun DD Shermans was undertaken to fulfil British requirements. Meanwhile in Britain a similar tank is fitted out with a replica of the tubular framework to show how it will accommodate the longer gun.

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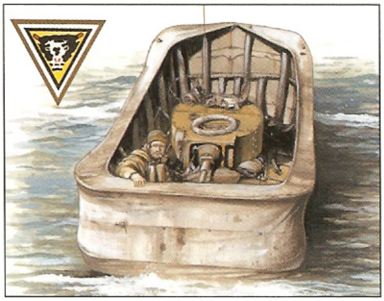
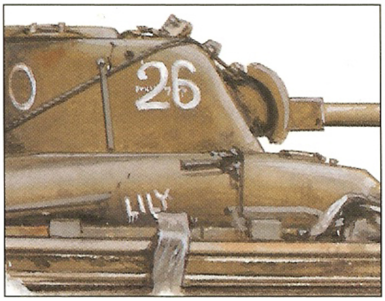
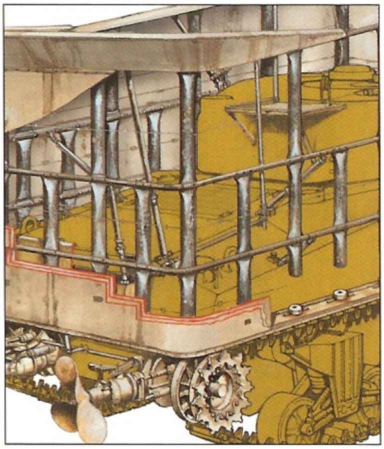
The design, development, operation and history of the machinery of warfare through the ages


Full colour artwork



Unrivalled detail


Cutaway artwork

Photographs

Shermans

Sherman DD amphibious tank of World War II

The Sherman DD (Duplex Drive) tank was a brilliant innovation; although the design and development of a tank that could swim in water was controversial. Each tank was enveloped in a waterproofed canvas screen, launched at sea from landing craft and then 'swam' to shore, where the screens were deflated, allowing the tanks to operate as fighting vehicles. This book follows the development of the DD tank through the Valentine to the Sherman DD and its many variants. It also examines the successes and tragic failures on the beaches of Normandy and further into north-west Europe, including the challenge of crossing the River Rhine.

US $15.95 / $22.95 CAN

ISBN 1-84176-983-5

51595

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